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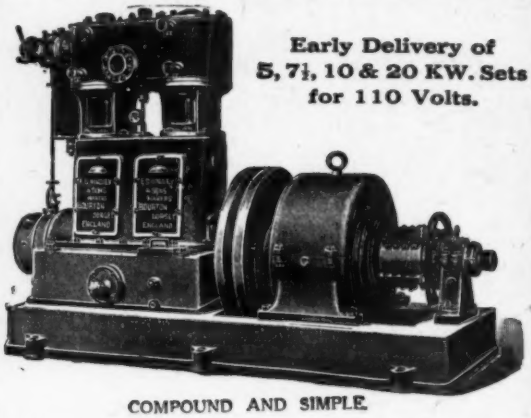

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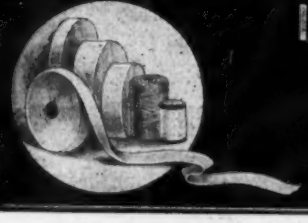

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ELECTRICAL REVIEW.

VOL. LXXXIX. SEPTEMBER 16, 1921. No. 2,286

ELECTRICAL REVIEW.

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THE RIGHT TO LIVE.

RECENTLY we were taken to task by a sceptical correspondent, who declined to believe that when we said that all should work, in order to rescue the country from the disaster to which it is drifting, we meant what we said. That such a comment should be possible, after we have preached for years that it is the duty of every fit man to work, is somewhat disheartening; but we are fain to believe that our critic is the solitary exception, and that our readers in general give us credit for sincerity. So firmly do we hold this doctrine, that we do not hesitate to say that those who do not work—when they have the opportunity—have no right to eat; and to this rule we admit no exceptions save those who are debarred from working by physical or mental incapacity.

Now, what applies to individuals often applies with no less truth and cogency to nations; and we are led to consider how far our rule holds good in wider applications. First let us recall a statement made by Mr. Edgar Crammond, which we quoted in our issue of September 2nd; he pointed out that if, as he feared, we were to lose a great proportion of our foreign trade, this country could only support a population of some 20 millions, and the other 26 millions would be compelled to seek a livelihood abroad. Do we fully realise what this means?

Again, a powerful article on "The Industrial Situation" was contributed to *The Times* on Friday last by Sir Alfred Yarrow, whose firm has recently taken steps to obtain first-hand information regarding the industrial conditions obtaining in Europe, America, and the Far East. He says: "We only grow enough to feed us for two days in the week; for the remaining five days we are dependent upon supplies from abroad. . . . The principal means we have of paying for what we import is by giving manufactured goods in exchange, and if we fail to supply foreign countries with such goods, they will not send us what we want, scarcity will result, and prices will inevitably rise. . . . We must be able to supply our goods at prices that will compare favourably with similar goods obtained elsewhere. If we cannot do this, then we lose our foreign customers and are unable to pay them for the necessaries of life." *Ergo*, we starve.

In the course of this most instructive article, Sir Alfred shows that the reason why we are outbidden by other nations in respect of cost of production is not high wages, but low output. High wages are not incompatible with low cost of production; and no rational employer would wish to see them reduced, if the output were high in proportion. Low wages and low output imply a higher cost of production than high wages and high output. Common sense, therefore, calls for the latter; and hard facts tell us that without low cost of production we cannot procure the means of subsistence from abroad.

Now, it is not within the power of any authority or Government to enact a law with regard to individuals that "he that will not work, neither shall he eat"; but in the economic world in which this nation dwells, that law holds sway regarding nations. *The nation that will not work shall not be supplied with food.*

Unless we work as hard as the Belgians, the Germans, the Americans, the Japanese, we shall inevitably lose our export trade—and starve.

It is a fact, established long ago, that there is no better worker in the world than the British workman; when he chooses, he can turn out a greater output than any other national, with equal effort. But he is saddled with restrictions imposed upon him by trade unions, trade customs, &c., and he fears that if he works hard, he will not only keep another man out of work, but his own job will soon be finished. We do not blame him for holding these views, sadly mistaken as they are; we blame his leaders, who, knowing the facts, have not the pluck to tell him.

It is as certain as anything can be that if we can quote low prices for exports, we shall experience a brisk demand for our products. Nations which produce foodstuffs in excess of their requirements want our goods in exchange for their surplus. The Germans are working very hard, and so far are they from "using up all the work" that out of their 90 millions there are fewer than one million unemployed. The Belgians, without the advantage of an excessively depreciated exchange, have been working hard ever since the Armistice—and they get plenty of orders. Hard work stimulates demand and reduces unemployment.

Another factor which increases costs of production, cost of living, and unemployment is the strike. This country has become notorious for strikes, which have had a most deleterious effect upon our foreign trade. We were glad, therefore, to see that the futility of continually striking had been borne in by experience upon some of the leaders of Labour, who, at the recent Trade Union Congress, set their faces against the practice and supported a resolution in favour of obtaining settlements by agreement.

It is, we think, of the utmost importance that employers should do all that is in their power to secure and retain the confidence of their employés, and to bring home to them the economic truths which dominate the industrial situation. This can only be done by making them conversant with the facts relating to the industry in which they are engaged, a task which calls for personal intercourse between the workers and the principals. In no other way can the fallacies be dispelled by which the worker's mind has been obsessed. The individual worker is no fool; if all the facts are placed before him frankly, he will draw the right conclusion. It is that which we have outlined above—that in order to live, this nation must work.

The Bakers' Exhibition.

Of the 20-odd firms that exhibited machinery at the Bakers', Confectioners', and Allied Traders' Exhibition and Market that was recently held at the Royal Agricultural Hall, London, only one or two showed electrically-driven examples. In the majority of cases the makers appear to build their machines with a view to their being belt-driven, a policy which adds to the difficulty of adequately protecting the operators and cleaners from the dangers which always attend moving machinery. Now, the advantages of the electric drive are too well known to need reiteration, but the whole thing seems to be governed by financial considerations; the provision of a motor adds enormously to the initial cost of the equipment as a whole—probably due to the fact that when an electric motor is supplied to drive, say, a dough-mixer, it is tacked on as an afterthought instead of being incorporated in the machine itself.

The latter method, however, is said to be not practicable in many cases on account of the difference in the speeds of the driving and driven machines, but the fact is overlooked that nearly always some form of gearing is incorporated in belt-driven machines, and even in the simplest arrangement the belt itself constitutes a speed-varying device. It is, therefore, suspected that the gear problem can be considerably simplified, and that it is not so real as it appears to be at first sight.

The true solution will be difficult to arrive at so long as the makers continue to produce the two machines separately; each endeavours to produce a beautiful piece of apparatus of very high efficiency and reliability entirely independently of the other, whereas what is of prime importance is not so much the efficiency of either, but of the combination as a whole—that is, input of the electric motor to output of the driven machine. Moreover, it should be borne in mind that electric motors would be perfectly useless, and there would be no demand for them whatever, if there was nothing for them to drive.

Under the circumstances a better policy to pursue would seem to be to design and manufacture the motor as a component part of the machine which it is intended the former should drive, and it is to be regretted that nobody seems to have attempted to tackle the problem on the lines suggested, whereby it should not be difficult to effect a material reduction in the cost of the motor and also improve the general arrangement of the combination as a whole.

Electricity for All.

In our "Correspondence" columns to-day Mr. F. M. West outlines a scheme for the introduction of electricity into half a million small houses every year, by means of a wiring corporation operating in conjunction with the supply authorities and the leading electrical societies. His reference to "the old National Free-Wiring Co." is perhaps somewhat ill-omened, for the experience of that body is not likely to inspire enthusiasm in the breasts of those who are acquainted with its history; the present, also, is not a favourable moment for enlisting capital for such a venture. Nevertheless, the idea should not be dismissed altogether without due consideration; we look forward hopefully to the time when circumstances will be more propitious to the flotation of such a scheme, which, if it could be carried into effect, would undoubtedly be very advantageous to that enormous body of small householders which at present is debarred from the use of electricity in the domestic *ménage* by the excessive cost of installation.

In this connection our thoughts naturally turn to the Fixed-Price Light Co., Ltd., which for some 11 years has been carrying out on a modest scale a system not materially different from that outlined by our correspondent, with excellent results; the company has some four or five thousand consumers of the artisan class, in various supply districts, and appears to be very well satisfied with its business. From this precedent we infer that our correspondent's proposals—which practically mean an enormous extension of this class of business—are not inherently fallacious, and we commend them to the consideration of our readers.

Railway Electrification Standards.

The final report of the Advisory Committee of the Ministry of Transport on this subject, which we abstract elsewhere in this issue, follows the lines of the Interim Report published a year ago, in that it abstains from arbitrary decisions and not only sanctions the continuance in operation of the various existing systems, but leaves the choice of system for future construction very largely open. The additional regulations relate mainly to the method of supplying electricity to the trains, and permit either contact rails or overhead conductors to be used, the former being either of the top-contact or of the under-contact type. As we said of the Interim report, "Clearly, therefore, uniformity is and will remain a long way off." The only definite standards laid down in the Report are those relating to the position and arrangement of the contact rails and overhead conductors with regard to the track and the loading gauge; these data, it must be admitted, are of great importance. Many changes and improvements can be effected on the rolling stock as time goes on, without affecting the line construction

appreciably; but to alter the latter after it had been put into use would be a vastly different question, and it is absolutely essential to the progress of railway electrification that the relations of the conductors to the permanent way shall be fixed and maintained constant from the earliest possible stage of development.

The Interim Report, while permitting alternating current to continue in use and to be extended where it was already installed, explicitly recommended the adoption of the direct-current system. As we have pointed out in these pages, the superiority of d.c. is far from being an ascertained fact, and we may not have to wait many years before the verdict is reversed. But we cannot wait for the conflict to be settled for us elsewhere—we must proceed with the electrification of our railways as quickly as possible; whether the choice is the best possible or not is of less consequence than the immediate adoption of a definite policy. The Committee, obviously, has not been able to go very far on the road of standardisation, for fear of restricting progress and improvement, but so far as it has gone it has done good service, and we hope that its work will result in the early commencement of the great task of electrification with which so many of our railways are confronted.

Capital Expansion in Germany.

Even after having made due allowance for the enormous depreciation of the mark, the fact remains that a very considerable augmentation has taken place in the emissions of new capital in the electricity supply and manufacturing industry, particularly the former in the course of the present year. According to figures which have been issued in relation to the electrical industry and gas works combined for the eight months ended with August, 25 new companies were formed in this period with a nominal share capital of 690,800,000 marks; 45 existing companies made increases of 1,014 millions of marks in the share capital, and 15 made issues of obligations or bonds for over 1,148 millions of marks. In fact, as a German newspaper points out, the capital requirements of the electrical industry in the present year have been greater than those appertaining to any other industry or to banking, insurance and transport. The principal portions of the amounts issued apply to the great hydro-electric works in South Germany. Thus the Walchensee works, the Central Isar Co., the Bavarian works, the Baden works, and the Neckar Co. alone represent 605 millions in shares and 700 millions in bonds, while the Neckar Co. is just offering 350 millions in bonds. These figures, however, by no means fully cover the capital requirements of the hydro-electric works in the South. Yet when we are told that Germany is impoverished, such figures for eight months of the year give rise to serious reflections as to the financial capabilities of Germany.

Congestion at the B.A. Meeting.

The Edinburgh meeting of the British Association concluded on Wednesday last, and it is safe to say that from every point of view it was a satisfactory gathering; quite up to the pre-war standard which, nowadays, is generally held to be a standard of excellence. The arrangements were all that could be desired in so far as accommodation, distribution of literature, and general facilities were concerned; in fact, we think the complaint we are about to make was the only "rift within the lute."

We were led to expect discussions on many of the papers, but, unfortunately, the programmes were so full, in most cases, that anything in the way of helpful comment or healthy criticism was precluded. Indeed, sometimes in addition to the arranged programmes, some of the Sections were asked to listen to unannounced papers which made discussion quite impossible, and occasionally upset members' plans. Several afternoon sessions were held by some of the Sections, but we do not think that members would like these to become a permanent feature of the meetings; if this were so the afternoon excursions, which add so much to the pleasure of the gatherings, would have to be abandoned.

We are therefore forced to the conclusion that either some of the papers must be published in advance, "taken as read," and discussed; the number of papers must be reduced; or the duration of the meeting must be extended. The last of these would be very acceptable to members whose business would permit of their staying, if every meeting was as pleasant as this year's has been.

The Wages Clause in Government Contracts.

One of the results of the Great War was to cause the introduction into an enormous number of Government and other contracts of a clause providing for the variation of price caused by higher wages. In some Government contracts the agreement or acceptance of tender provides that the price includes all increases in cost of labour or material to a given date, and that claims for increased costs of production *due to Government awards of higher wages*, or increase in the price of materials, shall be considered. The question what constitutes a Government award within the meaning of this provision has recently been considered by the Federation of British Industries in consequence of the refusal of the Admiralty to admit that the award of an Industrial Court is a Government award. The Admiralty, apparently, takes the view that an award of an Industrial Court is the outcome of a voluntary resort to arbitration by the parties concerned, and is not the result of an award authorised by Government. When appealed to, the Treasury refused to give any definite ruling on the matter, holding that it was for any party to take what steps he might think proper to enforce the terms of his contract. It is to be observed, however, that in a former contract with the Ministry of Munitions the following clause appears: "If during the currency of the contracts the cost of labour . . . shall have increased by direct Government action (as defined below) the contractor may claim and the Minister of Munitions shall repay any increased cost of production due to increased costs of labour, &c." The definition of "direct Government action" is in the case of wages:—"Any award as to wages made upon any reference for settlement under the Munitions of War Acts, 1915 to 1917, or any order or award as to wages made by the Minister or by any Tribunal appointed for that purpose pursuant to any Act of Parliament." The Industrial Courts Act, 1919, is stated in the preamble to be for "the establishment of an Industrial Court and Courts of Inquiry in connection with trade disputes, and to make other provision for the settlement of such disputes." It seems to be clear from this that under munitions contracts, at any rate, any advance in wages due to an award of an Industrial Court is the result of direct Government action; and it seems to be a technical distinction to say that the award of such a Court is not a Government award within the form of contract approved by the Admiralty. If it is not a Government award, what else is it? The employer who willingly accepts the award of an Industrial Court which has effect to keep up wages has yet to be found. Not only is he not a voluntary suitor at these tribunals, but he generally resents their interference with his business. A case recently came before a Court of Referees in the Metropolis where a question arose as to the terms upon which a certain man had left his employment. It appears that his employer had been summoned and fined for not paying wages in accordance with the scale fixed directly or indirectly by Act of Parliament. He paid the fine, and it may be he was compelled to pay arrears of wages due; but being determined to pay no more, he forthwith discharged some fifty workmen, including the man whose case was before the Court. To argue that he had voluntarily submitted to the award which settled the wages would be absurd.

ELECTRIC RESISTANCE FURNACES.

By E. P. BARFIELD, A.M.I.E.E.

THE heat treatment of steel by electricity opens a very wide field. Electric furnaces are equally as robust in construction as those heated by gas, oil, or solid fuel, and as they also possess greater advantages, it is of interest to both the electrician and mechanical engineer to know more about their sphere of usefulness.

No one will deny that the best steel is produced by the arc furnace, and similarly it may also be stated without fear of contradiction that the best tools, needles, engine and motor parts, &c., are produced when also hardened in an electrically-heated furnace of the resistance type.

A steel-hardening furnace is quite a simple affair. Briefly, it usually consists of a chamber closely wound with a resistance wire of uniform section and uniformly spaced, thus all the necessary conditions for uniform heating are present, illustrating the extraordinarily valuable application of electricity as a heating agent.

In the heat treatment of steel, uniform heating is of the greatest importance. With gas and oil heating there are variations of pressure and calorific value; with solid fuel there are also difficulties in obtaining and maintaining uniformity. In an electric furnace a given and uniform temperature can *always* be obtained in a known period, or a known temperature in a given period. Another important feature of electric furnaces of this description is the entire absence of fumes, and as there are no flues and the lagging is efficient, heat losses are negligible.

In gas, coal, and coke furnaces, the products of combustion entering the heated chamber affect the tools, &c., but in an electric furnace as there are no such deleterious gases the work is kept clean, and there is a minimum of scale. Even this can be further reduced by dipping the tools in thin mineral oil previously to heating—the oil carbonises and forms a protective coating which is easily removed. Temperature control in these furnaces is effected by means of a regulating rheostat.

The term "electric furnace" often conveys the idea, even to a practical engineer, that this appliance for the heat treatment of metals, &c., involves an elaborate apparatus with a complicated arrangement of circuits, switch gear, and other accessories, all requiring careful adjustment and control as well as constant expert attention, whereas it is really one of the most simple pieces of apparatus to erect, install, and operate. Assuming be leads are run to a position adjacent to where a furace is to be used, the whole work of erection and connecting can be carried out in under one hour; and as for working, an unskilled girl or youth, with a special type of furnace, can harden the most intricate articles with a certainty that outclasses a skilled hardener of many years' experience. The unskilled operator proves quite capable also of making any minor adjustments to the furnace that may be necessary now and again.

It is claimed that articles of steel hardened in an electric furnace are tougher, stronger, and better cutting than those produced in any other way, and numerous physical and wearing tests have undoubtedly proved this claim, whereas similar articles hardened in other types of furnace are not produced with any such certainty. Whilst they may be hard to the file, the hardness may have been, and too often is, obtained as the result of over-heating with a consequent loss of strength and useful life in the tools so treated.

The cost of electricity consumed is very low. Taking a basic charge for electrical energy of 1d. per kWh. the cost per ton of tools hardened is £1 14s. and, as already stated, skilled labour is not necessary even for the most intricate hardening.

One important feature in modern electric-furnace practice is an arrangement which will cut off the heating current at a pre-determined temperature, and so prevent damage in the event of an operator omitting the usual procedure of switching "off" a furnace when not in use. Refinements of this nature and other improvements introduced by various manufacturers of electric furnaces have not only rendered these furnaces "fool proof," but they have advanced their products to such an extent that to-day this country is the largest exporter of electric furnaces, and can compete in quality with any producers abroad. From these remarks it must not be inferred that the home or export business is enormous, for such is not the case, but its magnitude, in spite of the financial situation, is encouraging and steadily increasing.

The use of electric furnaces is not confined to steel hardening only; their industrial uses are numerous. For example, there are melting furnaces for use in the foundry, and rivet furnaces for correctly heating both iron and brass rivets; silver and gold annealing also offers a wide field. For dental work special furnaces are made for low-temperature work in the dental surgery, and a considerably higher temperature for the dental manufacturers in producing artificial teeth. Chemical furnaces are usually designed so that the heated chamber or container may be tipped and its contents emptied. Numerous other types of electric furnaces are made for different industries, and their adoption in place of gas-heated ones will certainly make far more rapid progress in this country when the commercial sides of electricity supply companies have a closer acquaintance with high temperature, and study the questions of heating applied to production in much the same way as the gas companies are doing.

The field for electric furnaces is not confined to large industrial centres; nearly every electricity supply company or corporation has a number of potential users, and from a purely electrical point of view the electric furnace load is well worth cultivating, as the power consumption for different-sized furnaces varies between 1½ kW and 20 kW, and larger sizes are in course of preparation. For night loads carburising or case-hardening furnaces should also be of interest to electricity supply authorities, these types of furnaces being usually charged with work during the day and switched on before the works close at night, and either switched off again first thing when the works reopen next morning or controlled by a time switch which comes into operation shortly before the works open. The operation of carburising in a furnace of this description is easier and far more certain in results than in gas, coke, or coal-fired furnaces.

All the pioneer work with regard to the introduction of electric furnaces to the consumer has been left almost entirely to the handful of manufacturers engaged in this branch of the industry. The Institution of Electrical Engineers has not yet recognised anything beyond arc steel-melting furnaces, which deal with the production of steel in tons, and are, of course, not applicable to ordinary engineering or similar industrial productions.

A large number of electrical engineers have never had facilities at their disposal to experiment in or obtain experience with high-temperature apparatus heated electrically, and consequently it is probable that they do not realise that muffle furnaces working at, say, 1,100 deg. C. are commercial productions used in numerous trades for various purposes.

It might be suggested that if commercial managers connected with the supply of electricity were to investigate the use of gas-heated appliances already installed in their consumers' premises, and communicate to manufacturers the size, purpose, output, and any other data available regarding the gas appliances used, in nearly every instance an electrically-heated appliance could be substituted.

THE CONTRACTOR'S FUTURE.

By L. G. HAWKINS.

The time has arrived when the future of the electrical contractor's business is being seriously challenged, and it must be decided immediately whether or not the electrical contractor is the right medium through which not only electrical labour-saving appliances, but all electrical supplies are to be sold and distributed, or whether other channels of distribution are to be chosen.

The actual answer rests entirely with the contractors; if they fail to recognise that the electrical installation side of their business is entirely separate from their sales side, they cannot hope to satisfy the public or manufacturers, which means that other sales outlets will be found.

"Miller" Lamp Department of the Chicago Retail Electric Shop.

A few years ago a similar condition existed in the United States. The condition was faced by a body of keen business men in the contracting world, with the result that to-day electric shops in America are the most up-to-date and attractive of any shops to be seen; they appeal directly to the womenfolk; they are always spotlessly clean; the goods are well displayed in attractively decorated windows; actual demonstrations or working models are usually in operation, and, above all, the sales assistants are practical men and women, who understand their jobs, and can demonstrate and explain the details of the apparatus in question. In other words, personality and knowledge in the electric shop plays just as important a part as in the hat or blouse shop. Sales assistants of this grade are not expected to clean windows, polish brass work, and at the same time to do sundry office jobs. To ensure the sales department being properly conducted and thus producing the maximum sales results, great attention should be paid to: (*a*) Displaying electric appliances; (*b*) popularising electric appliances by means of the following methods:—

1. Arrange proper demonstrations.
2. Arrange attractive window displays.
3. Prepare appropriate circular letters to consumers.
4. Arrange appointments for the outside representatives.
5. Prepare suitable printed matter.
6. Satisfy callers and secure all possible business, and educate the buying public to the use of electricity, &c.

How few electric shops in the British Isles are worthy of the name! But when one stops to think what a wonderful progress these few have made, it is surprising that before now some syndicate or other has not developed a chain of such shops throughout the country. It is a known fact that a large foreign manufacturing concern has opened its first electric shop in London, which is the first of many which are to be dotted in all of the principal centres to cater direct to the public—the idea being to give the British public the benefit of progress as far as the electrical shop is concerned. It is now up to the electrical contractors to be first in the field by getting busy immediately, and to develop before any outside organisation can scoop the market. Surely the Contractors' Association or the N.E.C.T.A. should immediately appoint a merchandising committee consisting of men of undoubted sales ability, and if necessary seek the aid and co-operation of men outside that Association. If once a chain of electric shops is established by foreign firms the local contractor's sales opportunities will be very poor, even though he may then be willing to make a show and do the thing properly.

Financial cramp and lack of organisation often deter the enthusiastic contractor from running an up-to-date and successful sales department. Is there any other trade which is so badly financed? Quite frequently the total assets of a budding contractor are a few pounds, a coil of wire, and a set of tools. How frequently he never gets beyond the starting stage. Even if he does, he is invariably in a more or less bad way. Would it not be a splendid thing if, in various centres throughout the country, contractors joined hands with their supposed rivals, and made one or possibly two contracting businesses with central offices and showrooms, from where the whole electrical business of the locality could be efficiently conducted, instead of possibly twenty small contracting businesses poked away in back alleys where

Interior of a U.S.A. Electric Shop; an Every-day Sight.

daylight has difficulty in penetrating, let alone the "lady of the house" who is out to be seen and out to see "things"? The advantage of such an arrangement would be:—

1. Pooled finances and central control, thus establishing a sound business.

2. Local co-operation between all contractors in *one* business instead of throat-cutting competition by twenty small concerns.

3. One efficient establishment; one set of books; one set of foremen and wiremen; one office staff; one telephone installation instead of twenty; in fact, a vast reduction in establishment charges all round.

4. The twenty contractors would become co-partners or officers of the one company, all seeking for work or carrying work through, or attending to sales as in the past, but with the tremendous advantage of knowing that their finances were in good hands and that the whole business was in a sound state.

5. Buying in bulk advantageously and being able to carry out contracts which small firms could not do, and which, therefore, would be passed to outside firms.

6. Properly catering for the electrical trade, and thus satisfying the public as well as the manufacturers, and ousting the possibilities of outside competition.

7. An analysis shows:—
   (*a*) Efficiency.
   (*b*) Reduced cost.
   (*c*) Better buying.
   (*d*) Profitable prices.
   (*e*) Good local showrooms.
   (*f*) Increased profits and assured success.
   (*g*) Greater facilities for contracting.

There are disadvantages in every scheme, but these usually are overwhelmed by the advantages, if it is a good one. Remember that this is only a suggestion, put forward by one who is keenly anxious to see the contractors grasp what should be theirs, and develop a sound merchandising department to their businesses on the most efficient lines.

Any group of contractors or individuals seriously interested in the plan outlined herein should communicate with the author at 116, Charing Cross Road, or the secretary of the Electrical Contractors' Association, 11, Southampton Row, London.

The illustrations accompanying this article show the types of electric shops which are common in the United States.

ARMATURE WINDING AND INDUCTION MOTOR DIAGRAMS.

By C. SYLVESTER, A.M.I.E.E., A.M.I.Mech.E.

There are very few faults to find with the practice of the modern armature winding shop. The formers are excellent, when compared with the home-made formers of the small winding shop of a few years ago, and the heating presses certainly make a good solid job of a completed coil so that they do not have to be handled so gingerly, the latter being against the interests of efficiency as far as the armature winder is concerned. It may be said, however, that considerable scope exists for the improvement of armature winding diagrams, that is, if the armature winder is to thoroughly understand them. Some of the armature winding diagrams issued by several of our large electrical engineering companies may be compared with nothing more or less than a Chinese puzzle, and armature winders in vain try to trace definite paths through a winding.

I have seen a complete winding diagram which showed a lap winding connected up to a commutator of 260 segments. The whole of the coils and circuits through the complete winding were shown and, from the pitch of the coils, the armature was clearly intended to operate in a six-pole machine. The whole of this winding was contained on a blue print 12 in. long by 8 in. wide. Upon looking at this diagram the thought immediately came into one's mind: "How careful a winder must be, if he is to connect up these coils correctly." There would indeed be very small wonder if, when a winder was tracing the circuits through this armature with a pencil, he strayed from one line and picked up another one, thus finding himself up against a "dead end."

It may be argued that modern machine shop practice entirely eliminates the possibility of an armature winder making a mistake when he is connecting up the coil ends to the commutator segments. It may be pointed out that the modern former forms the coils so accurately that they will literally *fall* into the correct position on the respective commutator segments to which they are to be connected. This point may be further driven home by a remark that, since all coil ends are fitted with coloured stockings, there is no necessity for the armature winder to know anything about the job. Surely there are no greater fallacies in existence than these. An armature winder does not always practise his art under workshop conditions. In some workshops winders are continually engaged upon one class of winding for, sometimes, months at a time. If, however, they are placed upon an entirely different type of armature, they experience some difficulty, for a time, in getting into the changed condition of affairs. Again, it is the practice in some winding shops for the shop foreman to place the first coil in its correct slots, and to lay the coil ends in the slots of the respective commutator segments. This, to a certain extent, makes things much easier for the armature winder, but not in the direction he most desires.

We will now consider the case of a large power plant, or traction system, situated some hundreds of miles from the factory where the electrical machinery was made. In almost every power plant will be found an electric motor which has been designed to meet special requirements. It may be a large motor for an air compressor with a very low speed, or it may be a motor designed to operate at full load under a very wide range

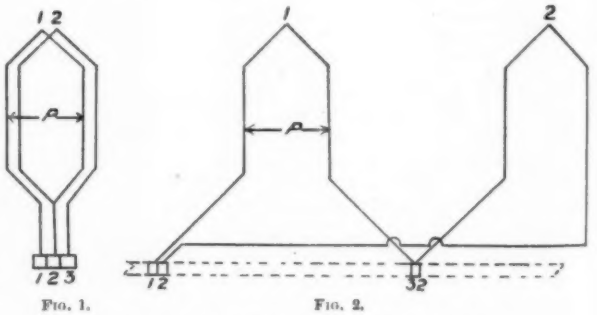


Fig. 1. Fig. 2.

Fig. 1.—Simplex Lap-wound Armature Diagram.
Fig. 2.—Wave-winding Diagram.

of speed. The fact remains that such machines are called for, and manufacturers have to deviate from their standard practice, and a machine is produced to meet these exceptional requirements. This being so, if a breakdown occurs to the motor, special component parts have to be made to cope with the breakdown, and, since no spare motor is available, the repairs have to be carried out as quickly as posible. It is in a case like this in which the armature winder is in need of the utmost assistance. It may be that an armature is completely burnt out and has to be rewound on site. The coils are hurriedly made in the winding shop, and a diagram is got out,

similar to the one I have described above. The coils, diagram, and necessary insulation and banding wire, &c., are handed to the armature winder, and he is sent away to do a job upon the success of which the reputation of his firm depends.

Under these conditions, therefore, the armature winder should be given a winding diagram which will enable him to follow the circuits through the armature with a minimum risk of making a mistake.

In fig. 1, I submit what I consider is an adequate diagram for a simplex lap-wound armature. This diagram shows two coils in position and the connections of the coils to their respective commutator segments. Regarding P, the pitch of the coils in the slots of the core, the blue print should definitely state this briefly as follows: P = 1 to 8, or 1 to 12, as the case may be. If the pitch is 1 to 8, then it naturally follows that the remaining coils will be placed in slots 2 to 9, 3 to 10, 4 to 11, and so on. Regarding the connection of the coil ends to the commutator segments, it would not be superfluous to add a few figures to the details of P, as follows:—

Coil 1, segments 1 and 2; coil 2, segments 2 and 3; coil 3, segments 3 and 4; and so on.

In dealing with wave winding diagrams we are handling a much more difficult task owing to the fact that top and bottom coils have to be taken into consideration. For an armature of fairly large size, a complete wave winding diagram is one maze of full and broken lines. The former represent top coils and the latter bottom coils, according to the system or procedure of the designer. That such a diagram is known to be complicated is quite clear from the fact that some engineers show the brushes on the inner side of the commutator, in preference to their correct position, since the latter would cover several coil ends and so lead to further complications. In fig. 2, I submit a wave winding dia-

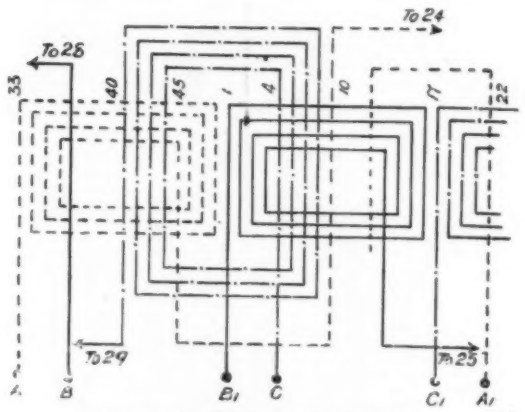


Fig. 3.—Rotor-winding Diagram.

gram which should make the connections quite clear to any armature winder. Here, as before, P represents the coil pitch. Two coils are shown in position with their ends connected to their respective commutator segments. The commutator is one of 61 segments. As with the previous diagram it is necessary to add a few figures to the details of P. In this case the following figures should be sufficient to give one a clear idea of the complete connections:—

Coil 1, segments 1 and 32; coil 2, segments 32 and 2; coil 3, segments 2 and 33; coil 4, segments 33 and 3; and so on. Is it not much better to use a few figures like these than to run the risk of straying from one line to another when tracing the circuits through an intricate winding diagram?

As with armature winding diagrams, those for induction motors need to be very easy for the "trouble man" to follow. The construction, or design, of the windings of induction motors is so varied, and it is possible that a winder may be sent to wind a rotor or stator which he has not seen before. In fig. 3, I show a rotor winding diagram which contains sufficient detail to enable any winder to rewind the rotor for which it is intended after a very brief consideration. The rotor has 48 slots. There are 4 poles with 4 slots per pole per phase. It will be noticed that the rotor is to operate on a 3-phase system. One phase is connected between A and A1, the second phase between B and B1, and the third phase between C and C1. The position of the windings for the three phases is clearly shown, and all that is necessary is to indicate, by means of figures, the slots to which each end of the windings should be conducted. There is obviously no necessity to draw a complete winding diagram as is often the practice nowadays.

Regarding fig. 4, which illustrates a stator winding diagram for 48 slots, 3-phase, 4 poles, 4 slots per pole per phase, the simplicity of this needs hardly any comment. As before the phase windings are between A and

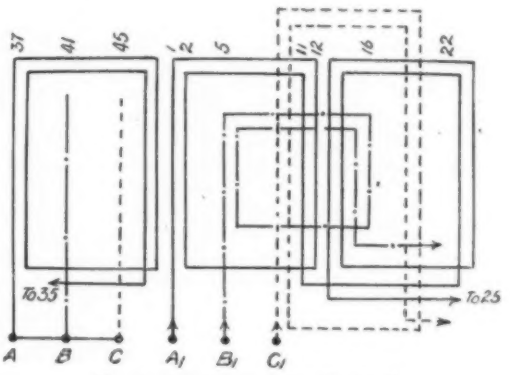


Fig. 4.—Stator-winding Diagram.

A1, B and B1, and C and C1; A, B, and C are connected up for star operation, A1, B1, and C1 being the ends of the windings to be connected to the three-phase supply.

The windings for larger motors may be treated in the same manner. It is merely necessary to lay out the positions of the windings as far as one pole in each phase. Beyond this, the use of figures should be resorted to, since these are much easier to understand than a mass of uncertain lines by the only person who really matters—the winder, who has to apply the diagram to his work.

Inter-Scandinavian Transmission of Energy.—The question of the electrical transmission of energy from Norway *via* Sweden to Denmark has been under discussion in the countries concerned for many years past, and has only now reached the stage of negotiations. These were begun at Christiania in the latter part of August, when Government commissions met for the first time to deal with the problem in its preliminary aspects. After the presentation of various reports on the question, the conference proceeded to appoint committees composed of two representatives of each country. The first committee is to investigate the electrical side of the problem of power transmission with regard to a line carried over Sweden, and as an alternative the laying of a cable under the Skager Rack. The second committee will deal with the legal aspect of the question, and suggest any legislative amendments which may be deemed necessary. When these points have been cleared up the purely business side of the question will be examined, and then the matter of organisation—whether the work will comprise an inter-State undertaking, be entrusted to a company, or be a combination in which the States themselves will participate. It appears that the Danish representatives have already put forward valuable information in favour of an alternative cable under the Skager Rack, while estimates for a land line *via* Sweden have been submitted both by Norwegian and Swedish authorities. Under the circumstances it is probable that many years will elapse before the scheme is carried into effect.

New Australian Cable Company.—A company has been formed by Messrs. Gibson & Sons, Sydney, with a capital of £250,000, to establish works near Sydney for the manufacture of telephone and electric transmission cables. The plant has been ordered and a staff engaged. The first unit is expected to be completed within a year. A contract has been placed with the company by the Commonwealth Postmaster-general's department for approximately £250,000 worth of cable. Most of the materials for the manufacture are produced in Australia.

THE SHIPPING, ENGINEERING, AND MACHINERY EXHIBITION.

Each of the exhibitions held at Olympia under the same organisation since 1914 has been more successful than its predecessor. On the occasion of the last undertaking, in the autumn of 1919, the distinguishing feature was the extensive and interesting Dutch section, but owing to the large representation of foreign interests, Olympia was taxed to its uttermost, with the result that all the applications for space could not be satisfied. On the present occasion, therefore, while the international character of the exhibition has been maintained, preference has as far as possible been given to British manufacturers.

In the absence of the president (the Hon. Sir Charles A. Parsons) the exhibition was formally declared open by Capt. H. Riall Sankey on September 7th, and in order to facilitate inspection by the public of the displays of the 360 odd exhibitors, the exhibition will remain open for three weeks. Recognising the educational benefit of an undertaking of this character, the management is offering special facilities to members of engineering institutions, technical students, works' managers and foremen, &c., to visit the exhibition; a series of lectures, papers, and conferences on various subjects has also been arranged, and in the kinematograph theatre films will be shown daily dealing with electrical and engineering subjects. For the first time since the war the railway companies have arranged to run excursion trains up to London, and it is to be hoped that they, in addition to the cheap tickets which are available to employers and others, will be made full use of by engineers of all sections. The broad educative effect of a comprehensive exhibition of modern engineering practice of this kind is too valuable to be neglected.

It is pleasing to note that in default of an electrical show, an attempt has been made to secure as impressive as possible a display of electrical and allied exhibits. Electrically-driven winches, capstans, and other auxiliary gear occupy nearly as prominent a place as do ship-lighting sets, while electric welders, furnaces, and switch and control gear are well represented. It is especially gratifying to be able to record that makers of electric heating and cooking appliances have fully appreciated the opportunity that is presented by this exhibition for emphasising the merits of the electrical method on board ship.

In the course of his speech at the inaugural luncheon, over which Dr. H. S. Hele-Shaw presided, Commander Sir Trevor Dawson (vice-chairman and managing director of Messrs. Vickers, Ltd.) compared the present industrial position of England with that of Germany, which country he had visited about a month ago. While there he had investigated the labour position in two great workshops—one electrical and the other steel and engineering. Both were hives of industry in which labour worked harmoniously, and from which output was very high. The electrical works had been allowed to write down their shops and machinery during the war to the extent that they stood in the books at one mark. Moreover, there were no taxes such as the munitions levy or the excess profits duty, and consequently they had been able to collect working capital to enable them to progress with peace products without any financial embarrassments. When the above conditions were considered, together with the fact that the average wages paid in Germany were of the order of four marks per hour for an eight-hour day, it was not difficult to realise how disconcerting was a comparison with the conditions obtaining in this country. [On Monday last the German mark fell in value to about ⅝d., the closing rate of exchange being 403½ marks to the British £. The pre-war value of the mark was approximately 1s., or 20.43 to the £.] Even during the stress of war Germany had studied and foreseen the economic position which would arise when hostilities ceased.

What follows is a brief review of the exhibits of an electrical nature, but very little of a really novel character appears to be shown, except in minor matters; there is no outstanding attraction. Nevertheless, there is a great deal on view that engineers of all grades should not fail to see.

On the stand of Messrs. Electrical Utilities, Ltd., the "Utility" current limiter, which has been described in our pages, is shown in conjunction with the "Sentinel" excess current indicator which consists of a resistance element, a portion of which is coated with urea crystals that are normally white in colour. If an excess current of about 2 per cent. passes, the coating will melt in from 15 to 30 minutes, and a permanent record of the passage of the overload is thus obtained.

The "Lightning" electric cooking oven that has been produced by the firm has been illustrated in our columns. It consists of a circular sheet-metal dome, inside of which, carried circumferentially, is the heating element extending from the top to the bottom, and is divided into three sections. The dome is attached to a counter weight, and can be easily raised or lowered.

The "Dim-Bright" adapter fitting shown on this stand is intended for use in conjunction with the new neon gasfilled electric discharge lamp. It consists of a polished brass globe with an adapter (to fit standard lamp holders) at the top and two lamp holders at the foot, the latter controlled by a cord-operated switch which puts one or other lamp in circuit. One night lamp and one bright lamp are inserted in the holders, and while the dim light can be alight continuously, consuming little current, a bright light is obtainable in a moment by pulling the cord.

Neon lamps in the form of signs, as described in our "Correspondence" columns last week, are also to be seen on the stands of the Rawlplug Co., Ltd., whose product is now well known in the electrical trade, and of Messrs. Thomas and Bishop, Ltd., who demonstrate the qualities of "Cling-Surface," a material used for treating belting; leather and textile belting when treated therewith can be run easy or slack, instead of tight, without slipping. Gale's commutator compound is also shown on this stand, which is claimed to remedy sparking, keep commutators clean, prevent cutting, and will not gum the brushes.

Fig. 1.—The Osglim Letter Lamp.

To return to the neon lamps, these are obtainable from the General Electric Co., Ltd., amongst others; they are a cheap means of lighting, and are very effective for sign illumination. As shown in fig. 1, each lamp contains a separate letter which glows with an orange colour. At present they are only obtainable for use on 200/250-volt circuits, but it will be appreciated that the problem of producing electric lamps of really low candle power and current consumption for use on ordinary

lighting circuits has at last been solved by the production of the "Osglim" (neon) lamp now in course of manufacture in this country. For such purposes as night lights, visual indicators, &c., at pressures of 200 volts and over the choice has hitherto lain between the 20-watt metal-filament lamp and the 5 or 8-candle-power carbon lamp consuming more than 20 watts. The new lamps present a successful and very interesting solution to this problem, and the patents covering them are jointly owned by the British Thomson-Houston Co., Ltd., and the General Electric Co., Ltd. "Osglim" lamps consume 5 watts as a maximum and produce a light which,

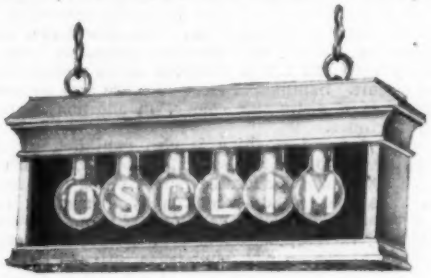


Fig. 2.—Osglim Hanging Sign.

although of low intensity, is amply sufficient for the purposes mentioned above.

An entirely new principle in lamp making is involved in the design, which consists essentially of two metal electrodes

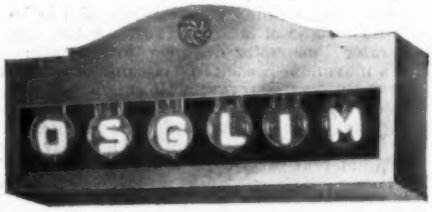


Fig. 3.—Osglim Pedestal Sign.

sealed into a glass bulb containing rarefied neon gas. These electrodes are connected to an electric circuit (either d.c. or a.c.) by a bayonet cap and holder in the ordinary manner. The potential difference between anode and cathode

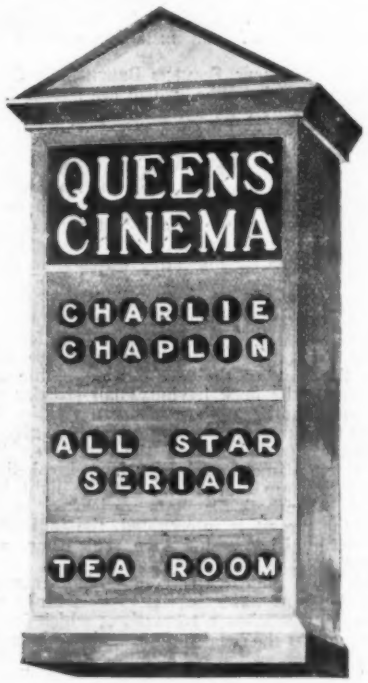


Fig. 4.—Osglim Theatre Sign.

produces an electrical discharge across the rarefied gas, and as a result of the ionic bombardment, a glow of a characteristic reddish-orange colour is produced as a luminous haze surrounding the cathode.

The construction of the lamp is simple, and the absence of a filament does away with the weakest part of an electric lamp. The mechanical strength is, therefore, very great, being limited only by the strength of the glass bulb.

At present two distinct patterns are made: The "letter" type (fig. 1) has the cathode made in the form of a block letter, numeral, or other simple device about 1½ in. high. This is principally used in simple signs for displaying a word or words which, by the way, are nearly as conspicuous in daylight as in the dark. The other type, for use where merely an indicator or safety light is required, has the cathode made of a thick wire spiral wound roughly into the shape of a beehive.

The glow is produced both on direct current, when the cathode only shows the glow, and on alternating current, when both electrodes are luminous. Some modifications introduced into the d.c. lamps, however, make them less effective on a.c. circuits so that in practice two separate types of this lamp are made. The letter lamps are made suitable for use on either kind of circuit.

The possibilities of the "Osglim" lamp are almost unlimited, and the many uses to which they may be put will be obvious.

The lighting lamps are primarily intended for dim illumination; they make excellent nightlights in nurseries, &c.; and in domestic illumination they have been used with good effect to add a touch of colour to the lighting scheme.

The General Electric Co. has designed an attractive range of signs for use with these lamps. Typical examples are shown in figs. 2, 3, and 4. A universal adjusting device is fitted to each lampholder so that individual lamps may be turned, raised, or lowered, to bring them into correct alignment.

Messrs. Siebe, Gorman & Co., Ltd., again exhibit their diving apparatus and smoke helmets, giving demonstrations several times daily in water and gas tanks, including the use of underwater illumination and the use of telephones by the diver while submerged.

Telephone apparatus is exhibited by, amongst others, the British L.M. Ericsson Manufacturing Co., Ltd., which has on view several types of instruments, switchboards, and accessories, as well as magnetos suitable for use on four-cylinder engines, and the Relay Automatic Telephone Co., Ltd., whose exhibit consists of a complete installation for an inter-departmental automatic system giving facilities for the connection of 50 telephones. It comprises the automatic switchboard, power board, two sets of 24-volt batteries, and instruments all connected up for use so that visitors can grasp the method by which the use of human operators is eliminated. A special feature of the system which will attract attention is the fact that there are no working parts as generally understood; the only movement is that of the armatures on the relays, which have an almost imperceptible movement when operations are going on. There is an entire absence of all electro-mechanical switches, and the great advantages which are obtainable by the use of this system include absolute secrecy, instantaneous connection or disconnection, and high speed of operation.

A further important feature is the fact that only two wires are needed from the switchboard to each telephone, and great saving in accommodation can be effected by its use.

Messrs. Evershed & Vignoles, Ltd., besides a selection of their standard instruments, exhibit an electrical helm or rudder indicator, which was originally introduced in 1893, and serves to indicate at any desired control position the degree of helm or angle of inclination of the rudder to the axis of the ship. By means of the hand-operated transmitter of the steer-

Fig. 5.—The Direction-of-Object Transmitter.

ing telegraph (an adaptation of the above indicator) at the control position the degrees of helm required can be signalled to any desired position, such as the engine room or steering flat. Needham's revolution counter and pulsator system of speed control and measurement has been described in our

pages, while Kilroy's stoking indicators have been in use since 1902; they are used to regulate the stoking of boiler furnaces and aid considerably in economising coal consumption.

The object of the Kilroy system of turret danger signals, which was introduced in 1907, is to provide on modern warships, in which the gun turrets have large arcs of training, a means of giving characteristic warning to those in charge, when the training of their guns is such that it would be dangerous to fire. The principle of the system is the completion or interruption, by the movement of the turrets or guns, of circuits supplying current to apparatus situated in the turrets, in such a manner as to operate a signal in a particular turret whenever the relative positions of that turret and the

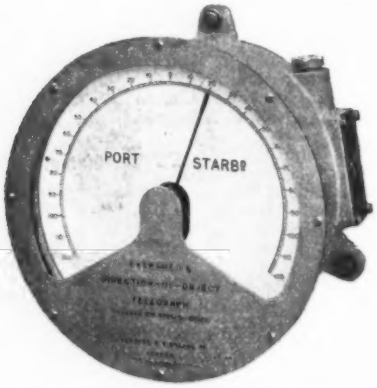


Fig. 6.—The Look-out Receiver.

object which may be endangered are such that it is dangerous for the turret to fire. The operation of the signal always means "Don't fire," and it is only given in the endangering turret. In British ships the danger signal is made by a trumpet worked by alternating current, adapted to give a loud and characteristic note whenever the circuit is completed. It gives also a visible indication. The alternating current is provided by a motor alternator run from the ship's electric lighting circuit.

The direction-of-object indicator or look-out telegraph, of which the transmitter is illustrated in fig. 5 and the receiver in fig. 6, enables a man in the crow's nest or forecastle of a ship to indicate at the bridge or other control position the bearing of an object at sea; it runs off a d.c. supply, and is independent of voltage variations.

The exhibits of some eight firms are of interest to electric welders. On the stand of Alloy Welding Processes, Ltd., is displayed a wide variety of welded articles and numerous types of coated electrodes, in addition to two improved sets of arc-welding plant. One is a completely self-contained petrol-driven set, and the other a motor-generator outfit, which has been designed to meet the needs of tramway engineers. Both sets are enclosed in sheet-metal covers and water-tight instruments, switchgear, and cable plugs are fitted to the ends of the steel enclosure; thus the whole presents a compact appearance, and can be used in the open without further covering. All the plant is shown in operation, as is also "Daysohms" a.c. plant, the special advantages of which are that the voltage used is only 50 and its high efficiency combined with light weight—namely, 3¼ cwt. complete. An early form of this machine has been described in our columns, but it has since been improved upon, and Messrs. Daysohms, Ltd., have recently been obtaining some surprising and extremely important results. Incidentally, it may be said that successful welds have been made with 45 and even 35 volts a.c. Hitherto the problem has been how to maintain the arc when using a low open-circuit voltage, but this has now been overcome. Moreover, in the past welds have been judged by their mechanical strength, but it is a well-known fact that a large majority of welds are much stronger mechanically than they need be. Now, if the voltage can be reduced and therefore also the kVA required without impairing the mechanical strength of the resultant weld, the subject will assume an entirely different aspect. This is the line on which Mr. Davies is working, and he has succeeded in increasing the weight of metal deposited per kWh consumed in an astonishing manner. This phase of the subject assumes much importance when it is realised that the cost of actual welding may thus be considerably reduced.

Messrs. G. D. Peters & Co., Ltd., show various railway and tramway fittings, and also apparatus for plastic arc welding on the Wilson system, by the use of which it is claimed to be possible to electrically weld any grade of cast iron, including malleable iron. The firm supplies a single-arc portable outfit that has sufficient capacity for cutting. It is driven by a 25-h.p. petrol engine, and the generator is a compound-wound 37-volt, 150-amp. machine, above which the control board is mounted crosswise. A similar set, but capable of supplying two arcs and having a capacity of 300 amperes, is also available, while the "Dynamotor" set is obtainable in a variety of sizes.

The welds to be seen on the stand of the British Arc Welding Co., Ltd., have all been submitted to tests, the results of which can be seen in the sample specimens themselves. In tensile tests of welds in mild steel Lloyd's tested plate, over 100 per cent. strength was obtained in the weld, and a welded pressure vessel, 12¼ in. external diameter, made from ⅜-in. ship's plate is shown, which has withstood a pressure of 4,500 lb. per sq. in. A large weld in 11/16-in. boiler plate was successfully made with the two sections securely riveted to an angle framework; this interesting weld of a rigid structure is exhibited.

The Premier Electric Welding Co., Ltd., demonstrates arc-welding plant both of the internal-combustion engine-driven and motor-generator types. The sets shown are of the single-operator pattern, and the firm claims to have entirely done away with the use of wasteful series resistances in the welding circuit. Samples of electrodes are also on view, each class being of a distinctive colour, in addition to resistance welding machines.

The latter type of machine is also exhibited by the A.I. Manufacturing Co., and is suitable for spot, seam, and butt welding, no flux or other foreign matter being required for the process. The stand is an exceptionally interesting one, and houses several machines for each of the three purposes mentioned above; their operation is demonstrated in conjunction with the use of special jigs, and special attention is drawn to the fact that the human element is practically eliminated in the working of the machines—they function correctly on repetition work under the supervision of unskilled labour. Of the several butt welders shown, two are semi-automatic, and a particular feature of the exhibit is that the furniture is in part welded; the fence enclosing the stand is made up of samples of spot, seam, and butt welding in a variety of applications, and the small table on which samples of work are laid out will also repay inspection.

Electric resistance-welding machines are also to be seen in operation on the stand of Messrs. Perkin & Co., Ltd., and a "single-operator" generator designed for metallic electrode welding to a maximum capacity of 175 amps. is shown by the Metropolitan-Vickers Electrical Co., Ltd. It is a motor-generator set with the starting and control gear panel mounted on iron brackets attached to the bedplate; the arrangement is designated semi-portable, being suitable for easy transportation between different parts of a works or shipyard. A selection of "Cosmos" domestic appliances, lamps, &c., is shown in addition to a 120-kVA, 3-phase ship's lighting geared turbo-alternator set mounted on a combined bedplate. The control of the 30-h.p. motor that is direct coupled to the winch exhibited is by means of push button automatic contactor gear, and the derrick is provided with a limit switch to prevent over-winding.

Messrs. Cuirass Products, Ltd., demonstrate the protective, insulating, and waterproofing properties of their products; their anti-corrosive paint resists the action of acids and alkalis, and is non-conductive, two coats being sufficient to withstand 1,550 volts as certified by the National Physical Laboratory. Samples of solid insulating material are also on view.

The exhibits of Messrs. Siemens Brothers & Co., Ltd., include engine-room telegraphs, which are shown in operation. The supply of electricity for actuating the apparatus is derived from a primary battery, arranged to be left in circuit continuously so as to be available at all times. The distance from the bridge to the engine room does not affect the operation of the telegraphs or diminish their positive action. Loud-speaking telephones for ships meet the need for means of communication between the bridge and various parts of the ship, including the engine room, and the helm indicator supplies a reliable means for indicating direct from the rudder to the bridge or wheelhouse the position of the helm. Means for testing the voltage of the battery and for checking the accuracy of the instrument are included in the apparatus. The navigation lights indicator forms a useful means for ascertaining whether the navigation lights of the ship are burning correctly. On the front of the case containing the apparatus is shown a plan of the deck having small circular windows in positions corresponding to those of the navigation lights. Indication that the lamps are burning correctly is given by means of small lamps situated behind the windows. Should one filament of a two-filament navigation lamp break the brilliancy of the indicator lamp diminishes, but the light is not quite extinguished: when both filaments are broken, or if from any other cause the circuit is interrupted, the indicating lamp is completely extinguished and, at the same time, a bell rings to call attention.

The water-depth indicator is a convenient means of ascertaining the depth of water in the various tanks of a vessel. The instrument comprises a transmitter which is operated by the pressure due to the height of water in each tank, an indicator, and a selector switch for enabling any one of the transmitters to be connected to the indicator. The distance of the tanks from the central position where the readings are taken does not affect the accuracy of the instrument.

Forbes's ship's log and speed indicator gives the distance travelled by the ship as well as the actual speed through the water at any moment. The transmitting portion is fixed in the ship's bottom, and consists of a valve through which can protrude, when indications are required, a bronze tube having one opening facing forward for the admission of the water

as the tube is carried forward by the ship, and another facing aft for the exit of the water. Between these openings is a propeller operating the transmitting mechanism, so designed as to make a definite number of revolutions while the ship travels one nautical mile. The tube can be drawn into the interior of the ship and removed for examination at any time. The receivers can be fitted in any desired position in the ship, and are operated electrically.

Wireless telegraph installations for ships, a distance pyrometer and thermometer apparatus, samples of cables and wires, and a selection of batteries and lamps are included in the exhibit.

(To be continued.)

A LONDON "TOLL" TELEPHONE EXCHANGE.

The volume of traffic passing over the trunk telephone system to and from London has for some years past been increasing at the rate of approximately 10 per cent. yearly, and is, in fact, fast approaching the limit of the capacity of that exchange, and the provision of relief arrangements has become a paramount necessity. The Post Office has therefore separated the longer from the shorter distance traffic and has allocated an exchange for the express purpose of handling the latter on more economical and expeditious lines. A building in Norwich Street, Fetter Lane, which had been acquired in 1914 for use as a relief exchange was available, but it was not possible to commence the erection of the new exchange until the end of last year. The exchange will be known as the London Toll Exchange, and is expected to be in full operation by September 17th.

In the process of designing the switching apparatus opportunity has been taken to introduce new facilities for the operation of the calls, so that connections to the provincial towns which are served by the exchange may be obtained on demand. Under the existing system a London subscriber desiring to call any town outside the London local service area asks for "Trunks," whether the town is situated just beyond the borders of the London area, or in the remotest parts of the United Kingdom. The caller's local operator then connects him to the London trunk exchange, which records his call and passes it on to a switching position, where it takes its turn with others which are awaiting connection. Under the new system a subscriber wishing to call any provincial town within a distance of approximately 25 miles radially from the centre of London, will ask for "Toll," instead of "Trunks." He will be connected to the London toll exchange, where the telephonist who answers him, besides recording particulars of the number, will herself establish the connection to the desired subscriber. In the majority of cases the call will be completed whilst the caller waits on the line, as in the local service.

In order to provide this improved service, the trunk lines from London to the provincial towns served by the new exchange have been rearranged in such a way as to place them all within the reach of every telephonist in the exchange. This has been achieved by the introduction of a multiple system, *i.e.*, repeating the switching jacks of all the lines around the exchange. A number of cables to provide additional lines are being laid where necessary on the provincial routes, to meet the traffic requirements and to ensure a reasonable probability of a trunk line, or toll line, being available to cope immediately with every demand. Many of these lines will be ready when the new service commences. When a call cannot be connected on demand, owing to the lines being engaged, a subscriber's application will be booked and completed as soon as the telephonist is able to find a free line, when the subscriber will be rung as in the case of a trunk call; but on the completion of the various cabling schemes delays of this nature should be infrequent.

At the date of opening the existing lines will be increased by 20 per cent. and the lines provided on the more important routes should be sufficient under present conditions for the immediate disposal of all traffic. In addition to the traffic outgoing from London the Toll exchange will deal with the traffic incoming from the provincial towns involved in the London Toll scheme; the arrangements for operating this traffic should speed up the service materially.

The total number of exchanges and rural call offices included in the London Toll area is 270. In the Toll exchange accommodation for 424 outgoing and 600 incoming toll lines to the provinces and for 500 outgoing and 600 incoming junctions to the London local exchanges has been installed. At the date of opening some 200 outgoing and 230 incoming toll lines and 347 outgoing and 221 incoming junctions will be connected, and in arranging the disposition of the toll lines at the switchboard allowance has been made for the connection of new lines, which will become available when the new cables are ready.

Special arrangements to assist the operating staff in "routing" the various calls have been made, and devices provided to reduce the operating time on the calls.

The success of the London toll service will depend not only on the staff of the telephone service, but also on the co-operation of the public. Before applying for calls to places outside the London local area subscribers should ascertain whether "Trunks" or "Toll" should be asked for. This may easily be done by consulting the list of exchanges in the toll area, which will be set out in circulars and the telephone directory.

THE ELECTRIFICATION OF RAILWAYS.

Final Report of the Advisory Committee.

Last October an interim report was issued by the Electrification of Railways Advisory Committee appointed by the Minister of Transport (Elec. Rev., October 8th, 1920).

The Committee has now issued its final report, dated June 30th, 1921, in which it confirms the recommendations of the interim report, and supplements them. With regard to contact rail collection of current, the Committee points out that the conductor rails must be so arranged that the same trains shall be able to run on railways employing a 1,500-volt supply and on those using 600 or 750 volts. The top-contact rail is generally used for the lower voltages, but the under-contact rail is also in use, and possesses advantages with regard to interference by the accumulation of ice and snow, and also with regard to the protection of men working on the track. Suitably designed shoes can be run interchangeably with either the top or under-contact type of rail. The Committee does not recommend the exclusive use of either type, leaving the door open to improvement in the design of either or both.

The Committee considers that a standard position outside the tracks should be defined within certain limits for the contact surface of the contact rails in relation to the position and level of the running rails, and recommends that in respect of new electrically-operated lines and extensions to existing lines the following regulations should be issued for securing interchangeability of running:—

(1) The contact surface shall be in the horizontal plane.

(2) The gauge measured between the centre of the horizontal contact surface of contact rails and the gauge line of the nearest rail of the corresponding track shall be 1 ft. 4 in.

(3) The vertical height of the contact surfaces above the plane of the top table of the running rails shall be:—

(*a*) for top-contact rails ... ... 3 in.
(*b*) for under-contact rails ... ... 1¼ in.

(4) The vertical height of the contact rail (including, where required, the protection over the top of the rail) above the plane of the top table of the running rails shall be such as to provide the necessary clearance from the load gauges from time to time in use.

(5) The under-contact rail, where employed, shall provide for the engagement of the contact shoe being made from the side nearest to the running rails.

(6) Above the level of the under-contact surface (3) (*b*) no part of the contact rail construction shall be at a less distance than 1 ft. 1¼ in. from the gauge line of the nearest track rail, and below the level of the under-contact surface (3) (*b*) at a less distance than 1 ft. 7½ in. from the gauge line of the nearest track rail.

(7) The vertical distance between the under side of any contact shoe in the free position and the plane of the top table of the running rails shall not be less than 1¼ in.

Existing equipments which do not conform to the above may be continued in use and may, subject to the approval of the Minister, be extended.

Similarly with regard to overhead collection, the following recommendations in respect of new lines and new electrical equipment of existing lines are made:—

(1) The standard clearances, after allowance has been made for curvature and super-elevation, including any movements of the live wire or conductors and lateral movements of the collectors, under any circumstances likely to arise, shall be:—

(*a*) Between the underside of any overhead live wire or conductor and the maximum load gauge likely to be used on the line:—

(i) In the open, 3 ft.

(ii) Through tunnels and under bridges, 10 in.

(*b*) Between any part of the structures and the nearest point of any live overhead wire or conductor, 6 in.

(*c*) Between rail level and overhead conductors:—

(i) At accommodation and public road level crossings, 18 ft.

(ii) At places where there is a likelihood of men in the conduct of their duties having to stand on the top of engines or vehicles, 20 ft.

(*d*) Between any part of the collector gear and any structure, 3 in.

In the case of the electrical equipment of existing lines the dimensions stated in (*a*) (ii) and (*b*) may each be reduced to 4 in. as a minimum; cases of exceptional constructional difficulty may be considered by the Minister as special cases, and existing equipments which do not conform to the above may be continued in use.

(2) The horizontal distance of the contact wire from the plane through the centre line of the track and perpendicular to the surface of the track rails shall be within the following limits:—

(a) At a height of 18 ft. above rail level, 1 ft. 3 in.

(b) At a height of 4 in. above the maximum load gauge likely to be used on the line, 1 ft. 9in.

(3) The weight and construction of the contact wire and supports shall be suitable for the passage of collectors exerting an upward pressure of from 25 to 40 lb.

(4) The width of the renewable contact surfaces of the collectors at right angles to the track shall not be less than 4 ft. and the extreme width over the horns of the collectors shall not exceed 7 ft. 6 in.

In the case of those railways that have already equipped any or all of their lines with overhead contact wires which do not conform to the above recommendations, the employment of these may be continued in use and may, subject to the approval of the Minister, be extended.

Having regard to the practicability of further standardisation of equipment by regulations, the Committee confirms the views expressed in the interim report to the effect "that such regulations should put no avoidable difficulties in the way of the adoption in future, with the approval of the Minister, of any improvements in methods or appliances which may from time to time become available with increasing knowledge and experience," and does not consider it desirable, in the interests of railway electrification, that further regulations (other than those recommended in this report) should be issued for the time being.

In October, 1920, the terms of reference were extended to cover the questions (1) whether any regulations should be made to limit the drop of potential in an uninsulated return conductor on electrically-operated railways; and (2) if any such limits are desirable, what limits these should impose, and under what conditions. On these points the Committee says:—

(1) The evidence given by the railway companies operating electric railways indicates that the cases of harmful effects due to a drop in potential substantially in excess of that allowed by Tramways Acts in earthed railway conductors have been few and unimportant, and readily corrected by the railway companies themselves on their own initiative.

(2) The clauses for the protection of observatories inserted in the Acts of railway companies applying for powers to operate their railways electrically have had, and continue to have, a retarding effect on railway electrification. The committee having heard in evidence officers concerned with the observatory instruments likely to be affected by the operation of electric railways, is of the opinion that the interests of observatories would in any case be sufficiently protected if the scope of the clauses referred to were limited to the portions of electric railways within the vicinity of the observatories.

(3) Some railways, by virtue of the wording of their Acts, are under no necessity to apply for new powers for electrifying their systems, and are therefore not placed under the disadvantage with respect to limitation in the drop of potential by their Acts as in the case of the other companies.

Having regard to these considerations and to the views expressed in the interim report, as well as to the difficulties in imposing any definite limit to the voltage drop owing to the variety of conditions which present themselves along different portions of any railways, the Committee recommends that:—

(1) It is not desirable that regulations should be issued to limit the drop of potential in an uninsulated return conductor on electrically-operated railways.

(2) In cases where it is found impossible to dispense altogether with the present obligations which are imposed upon railway companies by the protective clauses inserted by the Board of Trade and other authorities into the Acts of the companies, these obligations should be specified definitely in each particular case.

The various recommendations are thus summarised:—

Standard System of Power Generation.—Three-phase alternating current.

Standard System of Power Distribution.—Direct current.

Standard Pressure.—1,500 volts at sub-station bus-bars; in special cases a multiple or sub-multiple of 1,500 volts, if approved by the Minister.

Standard Collection.—Contact rail and/or overhead contact wire.

Contact Rail Standards.—Top-contact or under-contact rail, with the contact surface in a horizontal plane installed at a gauge of 1 ft. 4 in. from the gauge line of the nearest track rail.

Overhead Contact Wire Standards.—Installed normally over the centre of the track at a height of 3 ft. above the maximum load gauge likely to be used on the line, and at a maximum height of 20 ft. above track rail level.

Limitation of drop in Earthed Return Conductors.—No regulations to be issued.

Diagrams showing the suggested positions of contact rails and wires are appended to the report.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The Féry Cell.

The self-depolarising cell invented by M. Ch. Féry, which has been previously described in this column, has been considerably improved. In a note presented to the Académie des Sciences, and reproduced in *La Revue Générale de l'Electricité*, the author points out that the oxygen of the air enters into solution at the surface of the liquid, but in ordinary Leclanché cells the zinc rod extends to the surface, and being oxidisable, it combines with the dissolved oxygen and robs the solution of the depolarising gas, besides itself suffering local corrosion. Hence he places the zinc at the bottom of the cell in the form of a flat plate. The carbon, on the other hand, must be close to the zinc to reduce the internal resistance of the cell, and must also reach the surface of the solution, where the depolarising oxygen is found; hence the carbon takes the shape of a vertical cylinder, prism, or tube, as shown in fig. 1. When the cell is in operation, chloride of zinc is formed and remains at the bottom of the cell. The ammonium ions form with water ammonia, and hydrogen is liberated on the lower part of the carbon. When the cell is again on open circuit, the carbon element which is covered with hydrogen below and is bathed with an oxygenised liquid above, becomes in effect a short-circuited gas cell; by dividing the carbon it has been demonstrated that a current actually flows between the two ends of the carbon, and thus depolarises the element.

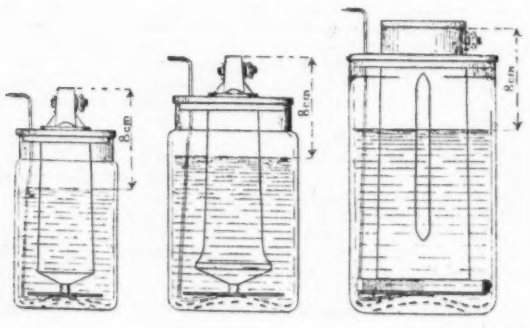


FIG. 1.—THREE TYPES OF FERY CELL.

It is claimed that the cell possesses great constancy, high efficiency (there being no local action), and freedom from "creeping," and as no manganese dioxide is required, it is cheaper than the Leclanché type, whilst it has a much longer life.

A Heating Stove for Soldering Irons.

As an alternative to the electric soldering iron, which does not suit every operator, the ELECTRIC HEATING CO., George Street, Croydon, has designed an electrically-heated stove for heating ordinary soldering irons (fig. 2). The company asserts that the usual type of soldering-iron stove is inefficient, owing to the fact that a large proportion of the heat has to pass across a considerable air gap before it reaches the iron, with a consequent waste of heat and loss of time. The chief object of the new stove is to overcome this defect. It is so constructed that the heat is transmitted to the iron direct through a pair of V-shaped jaws closed at the rear, one of which is movable so as to provide an expansible heating chamber which can be varied in size to suit irons of different sizes, the arrangement being such that, no matter what size iron is to be

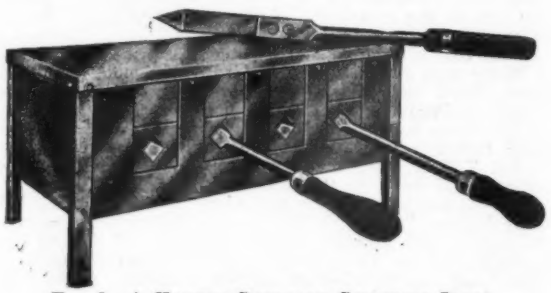


FIG. 2.—A HEATING STOVE FOR SOLDERING IRONS.

heated, the jaws will open and make direct surface contact immediately. The channels in the jaws can be made any shape to suit any iron, so as to ensure the maximum area of contact. The stove is made to take any number of irons at one time and each pair of jaws is lagged with heat-resisting material. The connections inside the back of the stove are made of corrugated strip nickel, so as to permit of easy movement of the jaws without damage to the connections.

One of these stoves is shown on stand No. L210 at the Shipping, Engineering, and Machinery Exhibition at Olympia.

The Foot-Candle Meter.

For economic and other reasons it is not possible to use electric light *ad libitum*, and it is therefore necessary to see that, while there is no waste, there is sufficient illumination for easy and accurate vision. A simple, convenient, and scientifically accurate means of measurement is afforded by the foot-candle meter, by the use of which the amount of light at any point on any surface can be measured quickly and easily. On the front of the instrument there is a screen consisting of a sheet of glass and two thicknesses of paper, one of which is perforated with round holes. This screen is illuminated from within by a small electric lamp fixed at the right-hand end. When the lamp is lighted the round spots to the right naturally appear brighter, and those to the left darker than the surrounding parts of the screen. The hole which is neither lighter nor darker than the surrounding screen, indicates the intensity in foot-candles of the external illumination on the face of the instrument.

The general view of the foot-candle meter (fig. 3) shows the graduated scale at the top, the voltmeter (bottom left), and the rheostat switch (bottom right). The locking pin in the switch handle prevents the lamp from being accidentally switched on, and also prevents the instrument from being put in the case when the switch is on. The total weight with the case is 4 lb., and the outside dimensions of the instrument are 7¼ in. x 6 in. x 1¼ in.

The dry battery supplying current to the lamp should be changed when difficulty is experienced in setting the volt-

Fig. 3.—The Foot-Candle Meter.

meter pointer to the arrow mark; any battery of the same size and type may be used as a replacement. The rheostat consists of a resistance in series with the switch, and by turning the switch handle until the voltmeter pointer is over the arrow mark on the dial, the resistance is so adjusted as to ensure correct voltage at the lamp. To use the instrument is simplicity itself; the meter is simply placed on the table, bench, counter, or wherever the illumination measurement is to be taken. After raising the hinged cover of the screen, the locking pin in the switch handle is lifted, and the handle turned to the right until the pointer of the dial on the left comes to rest at the arrow. A look at the screen will then enable the user to determine easily which of the round spots matches the background; the figure at the selected round spot gives the foot-candles. Thus the intensity of light may be measured as readily and accurately as a thermometer measures temperature.

The meter shows exactly what amount of useful illumination there is at the point where light is wanted; it does not measure the power of the lamp or the efficiency of the reflector —except by implication—but simply the final result. It enables the ordinary man to measure his lighting and say definitely whether more or less is needed, and provides that exact knowledge which is the first and most important step in the direction of true lighting efficiency. The meters are obtainable from the British Thomson-Houston Co., Ltd., 77, Upper Thames Street, E.C.4.

Metal Working in Germany.—It is stated that arrangements are being concluded between the A.E.G. and the Hirsch Copper and Brass Works Co., relating to the working of metals in so far as works or departments of the two companies are affected in manufacturing and sales.

REVIEWS.

Electrical Engineering. By T. F. Wall, D.Sc. Pp. x+491; 463 figs. London: Methuen & Co., Ltd. Price 21s. net.

The exact delimitation of the boundary line between text-books on theoretical electricity and magnetism and on electrical engineering is a matter upon which there may be wide divergence of opinion; the compromises suggested by such terms as applied electricity, technical electricity, and electrotechnics are a tacit admission of the difficulty. But it is not often that we find a book affecting so practical a title as "Electrical Engineering" devoted almost entirely to theoretical principles. Dr. Wall has certainly been unfortunate in his choice of a title for his book, for, while the fundamental principles of electricity, magnetism, and electromagnetic phenomena have been given clear and exhaustive treatment, the application of these principles to the generation, transmission, and utilisation of electric power, which is what one commonly understands by electrical engineering, has received but a very small share of the author's attention. We say this at the outset in no spirit of carping criticism, but rather in fulfilment of what we conceive to be one of the essential functions of a review, namely, to enlighten prospective readers as to the exact scope of the book.

In his preface the author summarises the fundamental experimental facts of the science of electrical engineering as follows:—

1. Coulomb's inverse square laws for electric charges and magnetic poles.
2. Faraday's law of electromagnetic induction.
3. Ohm's law of electric resistance.
4. Faraday's laws of electrolysis.
5. Ampere's laws of the equivalence of electric currents and magnetic shells.
6. Joule's law of the heat energy of the electric current.

Special emphasis has been placed on the importance of these laws; the book is, therefore, based upon very sound and orthodox foundations, and the care which has very obviously been bestowed on the explanation of first principles goes far to ensure that their application shall result in an equally satisfactory superstructure. But, to pursue the simile, in laying such sure foundations, the author appears to have utilised all his available building material.

We may illustrate our meaning by reference to section 1 which deals with static electricity. Dr. Wall mentions the fact that this subject usually finds but cursory treatment in electrical engineering books, and that the static electricity as dealt with in text books of physics is hardly as convincing to the electrical engineering student as it might be. With all of this we are in hearty agreement, and we turn to the chapter on this subject with considerable anticipation. We find, however, that after a discourse of 98 pages quite as theoretical, and in no wise more convincing, than the familiar "elements" of J. J. Thomson we arrive at a description of the Dolezalek electrometer. The electrostatic voltmeter, one of the most valuable applications of electrostatics to engineering goes unmentioned, and out of these 98 pages only the eight or ten devoted to cable dielectrics can be regarded as being in any way covered by the term "electrical engineering."

While the earlier portions of the section on magnetism suffer from the same academic style, the chapter on magnetic force and the magnetic properties of iron and steel is of a much more practical character. Even here, however, the tendency remains, and instead of following up a paragraph on "the pull between two magnetised iron surfaces" by the obvious practical application in Thompson's permeameter the author passes on to deal with the "change in direction of magnetic lines of induction when passing from one medium to another"—a no doubt very interesting, but far less practical matter.

The section on direct current electricity opens with a chapter on first principles in which the treatment is straightforward and elementary. The chapters on electric resistance, electrolysis, and thermo-electricity are excellent. In the first there are some useful tables of electrical constants and also a paragraph on the graphical determination of pressure drop in cables; in the second accumulators are treated in a brief but satisfactory manner; while in the chapter on thermo-electricity brief mention is made of pyrometers and the thermo-galvanometer. In every case the author makes much of the underlying principles, and introduces these technical applications by way of illustrating the principles rather than allowing a brief statement of the fundamental laws to preface a thorough-going account of their applications to electrical engineering practice.

Electromagnetism is dealt with under three headings: Magnetic effects of electric currents, electromagnetic induction, and electrical measuring instruments. In the first of these chapters the usual theorems are demonstrated, and considerable stress is laid upon the magnetic shell method of making investigations on the magnetic effect of currents. The magnetic circuit is also dealt with very sensibly at this point. Starting with Faraday's experiments and Lenz's law, the chapter on electromagnetic induction treats very thoroughly of the dynamo and motor and of self and mutual induction, while in the last chapter of this section galvanometers, the fluxmeter, oscillograph, wattmeters, ammeters, voltmeters, and frequency meters are discussed. The absence of any

reference to Irwin's oscillograph and the scanty paragraph on hot-wire instruments rather spoil a chapter which is in many respects admirable.

The chapters on alternating currents are much less conventional than those in the other sections of the book. The treatment of simple a.c. circuits naturally follows along well-worn paths; this is followed by a very complete account of single-, two-, and three-phase a.c. systems. In this chapter numerical examples are frequently worked out in illustration of the text, and a much more practical atmosphere pervades this part of the book than is evident in the earlier sections. It is true that the doctor draws his academic robe about him again when he proceeds to deal with harmonic analysis and the use of complex quantities (both, by the way, delightful little studies in mathematical physics), but he gets back to essentially practical things again in the chapters on magnetic fields due to a.c. currents and transients.

A very careful reading of Dr. Wall's attempt "to meet the demand for a complete survey in one volume of the principles of electrical engineering" convinces us that to cover all the ground that may be regarded as fundamental from the first experiments with glass rods and pith balls to the investigation of a.c. circuits by means of complex quantities in one volume necessitates so academic a type of treatment with consequent lack of the practical atmosphere as to render it of doubtful utility. The powder of "principles" and "theory" is so thinly covered with the jam of practical application in Mr. Wall's book that he was unwise to give it so tempting a label as "electrical engineering."—P.H.S.K.

Heating Systems: Design of Hot-water and Steam-heating Apparatus. By F. W. Raynes. Pp. 324; 158 figs. London: Longmans, Green & Co. Price 21s. net.

The author of this work is the head of the Department of Heating and Ventilating at the Royal Technical College, Glasgow, and his treatment of the subject is very thorough. The introductory chapter gives a survey of many systems of ventilation and heating, and the only two references to electric heating occur here. The author seems to be very favourable towards it, but objects to the cost. He thinks more might be done to lower the price of electricity for heating, especially in places where the period of minimum load concides with the time that heating is required. This, of course, is by no means an isolated opinion.

A great deal of attention is paid to systems of piping for hot water circulation, and methods of ascertaining velocities are explained in minute detail. Many types of valves and joints are illustrated and commented upon. Chapters are devoted to hot-water gravity apparatus, small-bore gravity apparatus, accelerated circulating systems, and forced hot-water circulation. Steam heating occupies a much greater part of the volume, and it is probably the section most likely to appeal to central station engineers. The systems dealt with are classed under various heads. The first part deals with the use of steam at low pressures, then the expansion of pipes and the methods by which this is provided for are given a chapter. Atmospheric systems of steam heating follow, and the use of exhaust steam for heating purposes is discussed. The author reviews the arguments for and against this method as compared with steam taken direct from boilers, and is of the opinion that a great deal depends upon the distance the steam has to be conveyed. The heat value of exhaust steam is worked into formulæ in which a large number of factors are taken into account. Electrically-driven pumps are recommended for use, under certain circumstances, in the return of condensate to the boilers. Vacuum and "vacuo-vapour" systems of steam heating are given two chapters. In the remainder of the work the subjects treated upon include heating surfaces, heat losses from buildings, boilers, and the temperature control of buildings.

An appendix contains 22 tables, which give information on properties of metals, properties of steam, hydraulic memoranda, pipes and flanges, and many other subjects. A fairly full index is included, as well as lists of plates, tables, charts, and formulæ.

BUSINESS NOTES.

Bankruptcy Proceedings.—M. Watkinson, H. Watkinson and A. Watkinson (Watt & Co.), electrical and mechanical engineers, Sheffield.—Receiving order made September 8th, on debtors' own petition.

F. Barraclough, electrical and mechanical engineer, late of Eastcliffe, Lightcliffe, Halifax.—First meeting, September 22nd, at the Official Receiver's Office, Byrom Street, Manchester. Public examination, October 12th, at the Court House, Salford.

C. P. M. Downie (P. Downie), electrical engineer and factor, Southend-on-Sea.—Application for discharge to be heard at Shire Hall, Chelmsford, October 17th.

B. E. Thomas, electrical engineer, 12, Castle Meadow, Norwich.—First and final dividend of 1s. 3d. in the £, payable September 17th at the Official Receiver's Office, 8, Upper King Street, Norwich.

Catalogues and Lists.—The Falkirk Iron Co., Ltd., Falkirk, N.B.—An illustrated leaflet (No. 264), giving a specification, prices, and details of the "Falco" electric cooker.

Messrs. L. G. Hawkins & Co., 116, Charing Cross Road, W.C.2.—An illustrated folder advertising "Universal" electric grills and other appliances.

X-Rays, Ltd., 11, Torrington Place, Gower Street, W.C. 1.—A folder giving particulars of X-ray photographic films and a leaflet announcing reductions in the prices of plates and films.

Messrs. Cowlishaw Walker & Co. (1920), Ltd., 14-16, Cockspur Street, S.W. 1.—Two booklets and a leaflet dealing with "Out-Put" bar and chain coal cutters and their advantages.

The Isis Electrical Co., 57, Albert Road, Aston, Birmingham.—A price list of stage arc lamps and accessories.

Messrs. R. B. Hodgson & Co. (Sheffield), Ltd., Sentinel Steel Works, Sheffield.—Catalogue S, giving exhaustive particulars of the properties and applications of "Pinnacle" steels.

Ebonestos Insulators, Ltd., Excelsior Works, Rollins Street, Canterbury Road, S.E. 15.—A circular letter giving prices of various sizes of "Ebonestos" conduit tube ends.

Automatic & Electric Furnaces, Ltd., 281-283, Gray's Inn Road, W.C. 1.—A well-illustrated publication dealing with various aspects of "Wild-Barfield" electric furnaces for the automatic hardening of carbon steel. Also "Heat Treatment Bulletin," No. 29, "The Perfect Hardening of Carbon Steel."

Mr. Charles Selz, 83, George Street, Portman Square, W.1.—A booklet illustrating, in colour and black and white, a variety of silk shades; also three leaflets upon the same subject.

Messrs. Charles Churchill & Co., Ltd., 9-15, Leonard Street, Finsbury, E.C. 2.—Publication C.P.L. 4, an illustrated list giving full particulars of "Carson" precision lathes with accessories—foot-power treadles, three-speed countershafts, &c.

Messrs. Rayner & Heald, Ltd., Duke Street, Derby.—Stock list of 2- and 3-phase induction motors.

Daysohms, Ltd., P. & O. House, 14-16, Cockspur Street, S.W. 1.—Bulletins Nos. 5, 6, and 7, dealing with patent regulators and arc welders for a.c. circuits; illustrated.

Simplex Conduits, Ltd., Garrison Lane, Birmingham.—An illustrated sheet dealing with "Triple-Purpose" illuminated signs.

Messrs. C. A. Parsons & Co., Ltd., Heaton Works, Newcastle-on-Tyne.—Pamphlet No. 11 S.T., giving very full details and illustrations of end-tightened reaction blading.

Mr. O. N. Beck, 11, Queen Victoria Street, E.C. 4.—An illustrated leaflet describing the "Paragon" boiler-tube loosener.

Enterprise Manufacturing Co., Ltd., Gun Street Electrical Works, Bishopsgate, E. 1.—A price sheet of ironclad switchgear, motors, starters, cables, &c.

Messrs. Guy Chantrill & Co., 6, Norfolk Street, Strand, W.C. 2.—List No. 52, an illustrated price-list of transformers of from 3 to 2,000 kVA; also blotters advertising "Viking" motors and transformers.

Catalogues Wanted.—The Hull Electrical Construction Co., electrical and mechanical engineers, Williamson Street, Hull, would be pleased to receive catalogues of electrical goods, particularly heating, welding, and X-ray apparatus.

Investment Companies in Germany.—The directors of the Electric Light & Power Investments Co., of Berlin, and of the Electricity Investments Co. have entered into an agreement under which the entire business management of the latter will be carried on for the account of the former as from the beginning of the current financial year, and shareholders in each company will receive the same rate of interest. An interchange of shares is also to be undertaken, and the Light and Power Co. will increase its share capital by 10,000,000 marks to 70,000,000 marks, and at the same time issue 5 per cent. debentures for 30,000,000 marks. A second company is to be similarly absorbed by the Light & Power Co.

The Stand Against German Dumping.—The shareholders in the Rheydt Electrotechnical Works of Max Schorch & Co., of Rheydt, have just authorised an increase in the share capital from 10,500,000 to 15,000,000 marks, and at the same time decided to relinquish their preferential right of subscription in favour of new interests which are taking over the shares at the price of 190 per cent., and also paying the cost of the issue. In return, these interests have undertaken to supply the company with orders. The directors in explanation of this procedure stated that otherwise it was very difficult for the electrical industry to obtain sufficient orders, as the export trade was almost entirely in a state of stagnation owing to the high import duties imposed both by former hostile nations and by neutral countries.

International Electrical Exhibition at Amsterdam.—It has been decided to hold an international electrical exhibition in the Paleis voor Volkvlijt, Amsterdam, for one month, extending from November 25th to December 26th. The exhibition is being organised by the Amsterdam branch of the Netherlands Association of Electrotechnical Employers in order chiefly to gain a great advertisement for the many applications of electricity so as to assist in bringing the electrical industry out of its present state of depression. Although organised purely by private interests, and without application to the Government or local authorities for subsidies, the exhibition has secured the honorary patronage of the Ministers for Home Affairs, Public Works and Education, the Mayor of Amsterdam, &c. The members of the Honorary Committee include the names of the directors of large electricity works, a representative of the State railway board of supervision, the chief engineering director of State telegraphy, &c. According to a Dutch contemporary, the administration of the exhibition is composed as follows and in the order stated:—M. Vorstman, director of the A.E.G.'s head office for Holland (president); J. C. Mollerus, administrator of the Netherlands Association of Electrotechnical Employers (secretary); W. Haaxmann, director of the N.V. Electrotechnical Bureau, late W. Haaxman & Co.; J. Dias Santilhaus and J. W. Borkus. It is further stated that Dr. v. Roosegaarde Bisschop, of London, is bestirring himself to secure the representation of English firms at the exhibition, while many inquiries are said to have already been received from other countries.

Book Notices.—"Lighting in Factories and Workshops."—Welfare pamphlet No. 7, issued by the Home Office. London: H.M. Stationery Office. Price 4d. net.

The Benjamin Electric, Ltd., of Brantwood Works, Tariff Road, Tottenham, N. 17, informs us that it will be pleased to forward a copy of the above pamphlet free by post to any interested reader.

"Robertson's Universal Method for Export and Import Trade," for computing and converting all the commercial trade quotations and exchanges of the world direct from the currency, and the weights and measures of one country, to those of another in one simple sum. Scott, Armstrong & Co., 79, Coleman Street, E.C. Price 2s. 6d. net.

Science Abstracts (A & B), Vol. XXIV, part 8, August 31st, 1921.—London: E. & F. N. Spon, Ltd. Price 2s. 6d. each.

Circular of the Bureau of Standards, No. 112, Telephone Service.—Washington: Government Printing Office. Price 65 cents.

"The Metropolitan-Vickers Gazette," Vol. VI, No. 101, August, 1921. Price 1s., post free.—Among the many interesting articles in this issue are, "Electrolytic Lightning Arresters," by W. A. Coates, M.I.E.E., and "High Efficiency Steam Turbines."

"Aggregation and Flow of Solids," by Sir G. Beilby, F.R.S., pp. xvi+256; 106 figs. London: Macmillan & Co., Ltd. Price 20s. net.

"High Frequency Apparatus," by T. S. Curtis. Pp. 14+270; 150 figs.—London: Page & Co. Price 9s.

"Radio Review," Vol. II, No. 9, September, 1921.—Wireless Press, Ltd. Price 5s. net.

"Proceedings of the Physical Society of London," Vol. XXXIII, Part 5, August 15th, 1921.—London: Fleetway Press, Ltd. Price 6s. net.

Excess Profits Duty.—The Montevideo Telephone Co., Ltd., having made application to the Commissioners of Inland Revenue for an increase of statutory percentage as regards the business of supplying telephone service throughout the Republic of Uruguay, the Board of Referees has ordered that the statutory percentage shall be increased:—

1. In the case of any trade or business carried on or owned by a company or other body corporate to 7½ per cent.

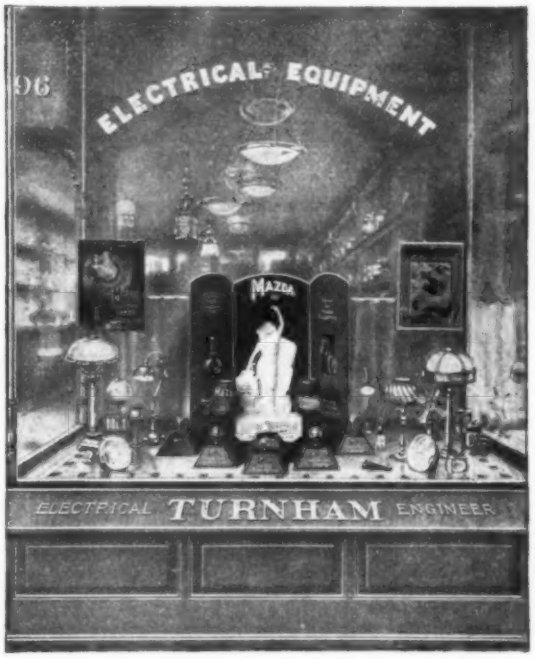
2. In the case of any other trade or business to 7½ per cent. plus 2 per cent.; except that for the purposes of sub-section (2) of section forty-one of the principal Act the statutory percentage shall be 7½ per cent. plus 1 per cent; with the addition, for the purposes of sub-section (1) of section 41 of, and paragraph 4 of part II of the Fourth Schedule to, the principal Act, of 3 per cent. for accounting periods ending often the 31st day of December, 1916, and before the 1st day of January, 1920, and of 5 per cent. for accounting periods ending after the 31st day of December, 1919.

For Sale.—By direction of the Disposal Board, the following sales by auction of machinery, electrical and other plant, will take place: September 26th and following days, at the R.E. Stores, Abbey Mills, Cody Road, Canning Town, conducted by Messrs. Bradshaw, Brown & Co.; on October 6th and 7th, at 46, Commercial Road, Portsmouth, by Messrs. King & King; on October 12th and 13th, at Holbrook Lane, Coventry, by Mr. C. E. Odell; on September 20th, at the Grilo-Oleum Works, Greenwich, by Messrs. Fuller, Horsey, Sons & Cassell; on October 5th and following day at Aintree, near Liverpool, by Messrs. Abram & Mitchell; and on October 6th, at Templeborough Stores, Tinsley, Sheffield, by Messrs. Eadon & Lockwood. (See our advertisement pages.)

On September 21st, at 119-121, Newington Causeway, Assets Auctions Co., Ltd., will sell the remaining stock of an electrical goods factor. (See our advertisement pages.)

Official Provincial Tour of H.M. Senior Trade Commissioner in South Africa.—Mr. W. G. Wickham, His Majesty's Senior Trade Commissioner in South Africa, is engaged on an official tour of this country for the purpose of discussing with firms the possibilities and conditions of United Kingdom trade with the Union of South Africa. The first part of his tour includes the following towns:— Leicester, on September 19th to 21st, Nottingham on September 22nd to 23rd, Sheffield on 28th to 30th, Leeds on October 3rd to 5th, Bradford on October 6th to 11th. Firms in these centres desiring to interview Mr. Wickham should communicate immediately with the Secretary of their local Chamber of Commerce. Arrangements to visit other industrial centres will be made and notified in due course.

A "Mazda" Window Display.—We have received from the British Thomson-Houston Co., Ltd., 77, Upper Thames Street, E.C. 4, particulars of a "window display" which they offer on loan to a limited number of contractors and dealers. The accompanying illustration indicates the nature



of the exhibit, which includes a variety of items capable of arrangement in many different ways; the display can be installed in a few minutes, and the window need not be cleared for its reception. The colour scheme has been carefully chosen, with Wedgewood blue and orange chrome predominating, and the design is calculated to arrest the attention of those who pass by the window. The displays are lent for a fortnight to dealers who stock Mazda lamps.

New Krupp Group.—Westphalian newspapers, says the Berlin correspondent of the Exchange Telegraph Co., report that the new trust formed by Krupp's, the General Electricity Co., the Rhenish Metal Works and the Wolff Co., has further big plans, which include the absorption of four new coal and engineering concerns, thus making the trust equal in magnitude to the Stinnes' electro-mining concern.

After the war the Rhenish Co. had less success than Krupp's in adapting itself to peace production, with the exception of the locomotive branch, in which it again became a competitor of Krupp's. It now employs 17,000 men. The General Electricity Co. is also producing steam as well as electrical locomotives, and it recently acquired an interest in the Linke-Hoffmann Works, of Breslau, one of the greatest of German locomotive concerns. More than half of Germany's locomotive production is concentrated in the new Krupp group.—*Financier.*

Lead.—In their report, dated September 10th, Messrs. James Forster & Co. state:—Board of Trade returns for August are as follows:—Imports, 10,845 tons; exports, 1,982 tons; leaving for home consumption, 8,863 tons. In addition to this, stocks in public warehouses have decreased by 871 tons to 11,515 tons, which would suggest a total home consumption of 9,734 tons on the month. Now that the considerable arrivals of lead at the end of last month and the first few days of this have been disposed of, there is again a periodical shortage of prompt lead, and premiums are being offered for immediate delivery. This position should be only temporary, however, sufficient supplies arriving in the near future to fill all present requirements.

A Floating Exhibition.—According to present plans a specially designed Exhibition Ship under the title of "British Industry," will set sail from the Thames in the summer of 1923, for the chief ports of the world. She will proceed to South America, South Africa, Australia, New Zealand, and Hong-Kong, via Japan, returning by the Straits Settlements, India, and the Mediterranean. During a voyage of 18 months' duration, a distance of 43,000 miles will be covered, and 34 important trade centres visited. The time table allows for a stay of from a week to a fortnight at each place, showing a total of 346 days during which the Exhibition will be open.

This British Trade Ship will be specially constructed for the purposes of an exhibition, and every detail of her equipment, from the engines to the fittings and furniture, will itself be an exhibit of British workmanship at its best. She will be as large as a first-class liner, having a gross tonnage of 20,000 tons, and in her internal arrangements will differ from any ship that has ever been floated. There will be eight decks, four of which will be devoted to the exhibition proper. On the other decks, besides the numerous cabins set apart for the trade representatives who will undertake the journey, there will be a large reception hall, offices, an inquiry bureau, a bank, an insurance office, interpreters' offices, telephone exchange, writing rooms, cloak rooms, and a restaurant capable of seating and dining 500 persons. A reception and ball room with domed roof extends nearly the whole length of the boat deck. A kinema, which can be used for exhibition purpose, and for showing processes of manufacture, is installed at one end. At the after end is a verandah café. On the shelter, bridge, and promenade decks are committee and private reception rooms, a spacious library, writing room, and smoking room.

The ship is to be specially built to the order of a company styled the British Trade Ship, Ltd., with registered offices at 12, Grosvenor Gardens, S.W. 1. The venture is likely to be of great benefit to the export trade of the British Empire, and should make a strong appeal to our merchants and manufacturers.

Swedish Telephone Business Abroad.—Speaking at the special meeting held in Stockholm recently of the shareholders in the Allmänna Industrie Aktiebolag H.T. Cedergren, when it was decided to amalgamate with the L.M. Ericsson Co., Mr. Winerantz, one of the directors, is reported to have stated that the agreement with the Polish Government had been approved by the latter in principle, and there was great probability of good results being achieved. As to the orders expected from Spain, the director mentioned that the company's representative in that country had reported that the exchange in Barcelona would be ready for conversion to the automatic system in December, and the telephone directors intended to entrust the work to the Swedish company. Concerning the English company, the director stated that it earned profits amounting to £13?,000 in the whole of last year, whereas the profits realised by the company in the first half of 1921 reached £49,000. The Mexican subsidiary possessed very favourable prospects on account of the increase in the subscription rates. At present the Stockholm company had orders on hand for 13,000,000 kr., and the turnover for the year was expected to be 18,000,000 kr., or the largest figures yet attained in any single year.

Our Foreign Trade.—August figures. The following were the values of imports and exports of electrical goods and machinery during August, 1921:—

	August, 1921. £	Inc. or dec. £	8 months, 1921. Inc. or dec. £
Imports.			
Electrical goods, &c.	91,972	−55,872	+560,924
Machinery	676,400	−1,414,812	−4,468,002
Exports.			
Electrical goods, &c.	875,920	−12,210	+2,605,810
Machinery	5,152,705	−377,992	+15,706,125
Re-exports.			
Electrical goods ...	11,825	−863	+80,146
Machinery	185,527	+17,687	−182,476

Swiss Imports.—The Expert Commission for the restriction of imports has resolved to recommend the Federal Council to impose limitations on a further number of articles, including electrical apparatus.

The Entz Electric Transmission.—In our issue of December 26th, 1919, we published a description by Mr. F. H. Hutton of the Entz electric transmission system used in the Owen magnetic car. We now learn that arrangements have been made to produce in this country two models of cars built on this system. Known as the "Magnetic" cars, they will consist of a four-cylinder 15.9-h.p. and an eight-cylinder-in-line model of 30/50 h.p., the bore and stroke in each case being 80 by 130 mm. Features of the specification are single-sleeve valves, Zenith carburetter, and M-L magneto, while in addition to two mechanical brakes on the back wheels, a two-step electrical brake is incorporated with the transmission. The "Magnetic" cars are being made by the Magnetic Car Co., under licence from the Magnetic Transmission Co., which owns the British patent rights for the Entz system. The new cars will be entirely of British construction. It is said that they will be ready for exhibition at the forthcoming Olympia Show.

Applications for British Trade Marks.—Appended is a summary of the recent applications for British trade-marks in respect of goods and productions connected with the electrical trades and industries:—

Eureka. No. 414,491. Class 8.—Electric voltmeters and ammeters, fitted electrical switchboards for use on motor vehicles, and for the like purpose, &c.—Joseph Tomey and Sons, Ltd., Manor Glass Works, Catherine Street, Aston, Birmingham. April 21st, 1921.

Duplex. No. 416,248. Class 10. Mechanical and electrical clocks.—Gent & Co., Faraday Works, St. Saviour's Road East, Leicester. June 8th, 1921.

Reflex. No. 416,249. Class 10. Mechanical and electrical clocks. Gent & Co., Faraday Works, Catherine Street East, Leicester. June 8th, 1921.

Nega. No. 410,500. Class 4. Carbons for electrical purposes.—Eugen Conradty, trading as C. Conradty, 9, Spittertorgrabe, Nuremburg, Germany. December 8th, 1920.

Snow. No. 411,936. Class 6. Electrically-operated grinding machines for millstones.—R. G. Haskins Co., 27, South Desplaines Street, Chicago, U.S.A. January 26th, 1921.

Dictograph (lettering and design). No. 409,041. Class 8. Telephone instruments and apparatus.—Dictograph Telephones, Ltd., Dictograph House, Denman Street, London, S.E.1. October 23rd, 1920.

Gramag. No. 412,527. Class 6. Permanent magnets, being parts of machines other than agricultural or horticultural machines.—Edward A. Graham, St. Andrew's Works, Crofton Park Road, London, S.E.4. February 15th, 1921.

Clem. No. 414,337. Class 13. Electric filament lamps.—Midget Lamp Co., Ltd., 2, Bothwell Street, London, W.6. April 14th, 1921.

Greenbat. No. 414,226. Class 22. Electric trucks.—W. Goodyear & Sons, Ltd., Churchfield Street, Dudley. April 12th, 1921.

Kaleaner. No. 413,329. Class 50. Impregnated electric insulating tape.—Callender's Cable and Construction Co., Ltd., Hamilton House, Victoria Embankment, London, E.C. April 11th, 1921.

Pensor. No. 414,915. Class 13. Incandescent electric lamps (ordinary).—Alfred N. Greening, 15, Clifford's Inn, London, E.C.4., May 5th, 1921.

Fire.—The British and Allied Electrical Agency, Ltd., state that their business is not interfered with by the fire which occurred at their address in Charterhouse Street, E.C., their offices being left untouched.

Electrically-heated Incubators.—With reference to the note in our issue of September 2nd, regarding the equipment of incubators and brooders with electric heating devices in America, Messrs. Automatic & Electric Furnaces, Ltd., inform us that for some considerable time they have been equipping these devices in England with heating elements and their Wild-Barfield automatic temperature regulator. With this device they can regulate the temperature to within half a degree either way.

German Export Prices.—The German Foreign (Export) Trade Control Department points out that the recent further depreciation of the mark has led to the conditions that inland prices are frequently lower than the world market prices. This difference naturally is an incentive to increased exports. While larger exports are desirable just now at a time of unfavourable activity, the Department says that sales at prices far lower than world market quotations operate prejudicially on the market situation abroad and on the relation with foreign countries. The proof of this is afforded by the large increases in Customs duties which have been made in the meantime. German exporters must, therefore, it is said, endeavour to follow the fluctuations in prices, and with a falling mark demand higher prices or sell in foreign currency at the outset. As, however, a number of merchant firms, in the effort to take advantage of the present situation for themselves, do not follow this system, electrical manufacturers have expressed a wish for greater protection against these conditions, especially producers of electrical conductors, in which a keen price contest is proceeding between various groups in the home market, and makers of primary batteries. Under the circumstances, it is suggested by makers that works' delivery certificates, which show sale prices and destination of export orders, should be reintroduced, as these would doubtless largely put an end to cheap exports.

Germany's Trade.—The September report of the Prussian Ministry of Trade states that the manufacturing boom is continuing in almost all branches of production, says the *Evening News*. Although home prices continued to rise in August the fall in mark exchange attracted large foreign orders, and home buying was also extremely active. The iron industry has abundant orders for months to come, and the Rhenish-Westphalian iron and steel concerns are refusing to take any further orders for fulfilment this year. The buying public is actuated by the belief that the impending taxes will further raise prices, and is therefore in a hurry to lay in supplies. Home business in the engineering industry is good only in some branches, but export orders are increasing. The improvement in the electrical branches continues, and there is a good demand for motors and installation material, but the cable branch is depressed.

Copper and Lead Prices.—Messrs. F. Smith & Co., and Messrs. James & Shakespeare report September 14th:—No change in last week's quotations.

Musical Advertising.—After music in education at the B.A. meeting, music in advertising. The St. Helens Cable and Rubber Co., Ltd., has just published, in connection with its *band* tires, "The Driver's Rosary," four verses set to music. As a new departure in advertising we think it worthy of inclusion in our "Business Notes."

Rumanian Samples Fair.—The Rumanian Legation states that the opening of the Samples Fair and Exhibition at Bukarest, which was to have taken place on September 12th, has been postponed until September 16th.—*Reuter.*

Transmission at a Million Volts.—According to a Reuter dispatch, the American General Electric Co. reports that on September 13th for the first time in history it "generated and transmitted an excess of a million volts pressure by a transformer equipment designed along standard lines with current at 60 cycles per second." "The physical laws applying to the behaviour of high voltages," it continues, "were found to hold good at this enormous pressure. It was found possible to confine and send the current over the wires without prohibitive waste due to leakage into the air. The test has confirmed the belief that it is commercially feasible to use a considerably higher voltage in the transmission of power, and indicates an extent of long-distance transmission beyond the limits hitherto believed to be possible."

Dransfield's Special Voltmeter.—Referring to the note on page 317 of our issue of September 2nd, describing "Dransfield's Special Voltmeter," Messrs. Ferranti, Ltd., inform us that they hold the selling rights of this instrument, and send us a copy of their List Ga200, which illustrates and describes the instrument.

LIGHTING AND POWER NOTES.

Australia.—Sydney.—The report of Mr. Justice Wade, who was given a Royal Commission to inquire concerning the cost of producing electric light and power within the City of Sydney is available. His Honour states that the City Council claimed that the cost of generating and supplying electricity had increased since 1915 by .6762d. per kWh. Each increase of one one-tenth of a penny per unit means £40,000; consequently, in money terms, the claim, if granted, would provide additional revenue of £240,000. Worked out in pence, representing the cost per unit, the production price in 1915 was 1.1760d., and in 1921 1.8522d.

Figures produced on behalf of the Electric Light Corporation showed substantial increases under the same three heads, and his Honour accepted the first two as fair and reasonable. The first two showed an increase in the six years of .4104d. per unit.

His Honour therefore declares an increase to the City Council in production cost of five-tenths of a penny per unit, representing an additional charge to the consumer of £200,000; and to the Light Corporation of four-tenths of a penny, representing a further charge on the consumer of £14,648. "The additional revenue," he says, "is sufficient to enable each of these bodies to meet the increased cost of production, also to maintain their undertakings in a sound financial position, and present a surplus finally in excess of what is necessary to meet liberally their present obligations."—*Daily Telegraph.* (Sydney).

Aylesbury.—Loan.—On September 1st, Col. E. T. Ekin, on behalf of the Electricity Commissioners, held an inquiry into the application of the Town Council for sanction to borrow £27,632 for electricity extensions. The town clerk reviewed the financial position of the undertaking, and stated that the present loan would be spent upon plant of the capacity of 1,500 kW. The present capacity of the works was 1,400 kW, while the connections amounted to 840 kW, with a prospect of an immediate additional 200 kW. Mr. H. P. Bartlett opposed the Council's application; he said that the undertaking was constantly making demands upon the rates, and the prices charged for energy were too low. The Inspector pointed out that postponement was impossible if the plant was to be installed in time to meet the 1923 demand. The result of the inquiry will be made known in due course.

Ashington.—Public Lighting.—The Urban District Council has entered into an agreement with an electric lighting company for the lighting of the district, for a period of ten years, at a cost of £7,040. The scheme provides for 703 lamps which it is considered will meet adequately the requirements of the district.

Birkenhead.—Loan Sanctioned.—The Electricity Committee has received the sanction of the Electricity Commissioners to borrow £15,000 for mains and £5,000 for services.

Bishop's Castle.—Price Increase.—The Town Council has consented to the Electric Light Co. increasing its charge for electricity from 9d. to 1s. per unit, for a period of six months.

Barrow.—Full Time Resumed.—The Electricity Committee recently reported to the Town Council, that an interview had been given to a deputation from the local branch of the Electrical Trades Union, with reference to the working of short time, and it had been resolved that the working of full time be resumed as from September 11th, in view of the fuller use of electricity by consumers in autumn and winter, and the necessity for efficiency at the works.

Bradford.—Price Revision.—Mr. Thomas Roles, the city electrical engineer, has written us with reference to a number of "alarmist" reports as to the financial position of his department which have recently appeared in the lay Press. The rumours arose out of a recommendation that the charges to power consumers should be revised. Mr. Roles states that a considerable number of these consumers have not yet paid 50 per cent. above the pre-war rates, and, prior to the last increase, not more than 33⅓ per cent. Long-hour consumers, however, have been called upon to pay 100 per cent. increase or more, and it was accordingly recommended that all consumers, as nearly as possible, should be charged on a basis of 75 per cent. above the 1914 rates. It will thus be seen that no attempt to enforce exorbitant charges is being made, as has been suggested by the newspapers referred to above. The new maximum charge will only be 3½d. per unit. In a statement to the Council, the Chairman of the Electricity Committee admits that a loss was incurred during the coal strike, but the statement that the deficiency amounts to thirty or forty thousand pounds is absurd.

Motor-hiring Charges.—The Master Bootmakers' and Repairers' Association is to send a deputation to the Corporation, with a request for a reduction in hiring charges for motors for boot repairing work. It was stated that when the matter was raised early in the year the association was told that the question would receive favourable consideration so soon as the cost of motors and renewal parts came down, and the association contends that the cost of such parts, owing to a reduction of the price of materials and in engineering wages, is now about half what it was at the beginning of the year. In view of an expected increase in charges for power, it is also contended that the matter depends on the cost of motor parts and not on cost of electricity production, and therefore the reduction should be made.

Continental.—France.—Bouches-du-Rhône, the Department of France in which the town of Marseilles is situated, proposes to undertake in the near future a number of costly public works. His Majesty's Consul-General at Marseilles (Mr. E. Vicars, C.B.E.) has summarised for the information of the Department of Overseas Trade, an account of these works given by the chief engineer of the department.

The first scheme will involve the construction of a small dam on the Durance, from which the water, calculated at an average volume of 150 cu. ft. per second during the six months of high water, although considerably less during the remainder of the year, will be deflected to a power-station at Movrargues, where it is estimated that an average of 32,000 kW will be generated. After leaving this station that water will be carried by a canal to a second one, situated at St. Christophe, also with a capacity of 32,000 kW in normal conditions. The power generated at the Meyrargues station will be utilised for pumping water to the arid plain of the Crau, and for drawing off the salt water from the adjoining Plain of Camargue. The St. Christophe power station will, on the other hand, be used to supply electricity to Marseilles and the Department of the Bouches-du-Rhône for various public services, any surplus available when these needs are satisfied to be placed at the disposal of electric light and power companies. It is estimated that the power generated at these two stations on the Durance will be cheaper than that produced by the private electric companies of the district.

A second scheme projected includes the electrification of the Departmental light railways, and the construction of new lines.

The third scheme is for the construction of waterworks at Fontaine l'Eveque (Var).

The cost of those schemes is estimated as follows.—

	francs.
Power stations on the Durance and laying of power-lines	160,000,000.
Works on Crau and Camargue	36,000,000.
Extension and electrification of departmental railways	80,000,000.
Fontaine l'Eveque Waterworks	245,000,000.
Total	521,000,000.

These ambitious projects have not passed beyond the preliminary stages, but now that the department has taken them up and given them publicity, it may be assumed that it is intended to carry them into effect with as little delay as possible.

Germany.—Owing to a strike of the employés of the municipal electricity and tramway departments Berlin was deprived of lighting, power, and transport on September 12th. The trouble was due to a rearrangement of the salaries of a number of higher-grade employés. It was later announced that the strike was settled on the following day.

Chipping Norton.—Inquiry.—The Electricity Commissioners recently held an inquiry into the application of the Chipping Norton Electric Supply Co. for permission to increase its maximum charges for electricity to 1s. 3d. per unit for lighting and to 7d. per unit for power. The managing director of the company said that the cost per unit sold had risen from 1.9d. in 1914 to 9.2d. in 1921. The Inspector asked if the latter figure was justified; was there any reason to suppose that the cost in 1921 would be 50 per cent. above that of 1920? The managing director said there was, and also thought that to give the shareholders a fair return the price should be 1s. 5d. a unit. On behalf of a number of consumers, Mr. T. H. Pettipher asked for a six months' adjournment; he said that the company's application was based entirely on this year's figures, rendered abnormal by the coal strike.

Coleraine (Co. Derry).—Water Power Concession.—At a recent meeting of the Urban Council, it was intimated that the Honourable Irish Society had consented to lease the water power at the Salmon Leap on the Bann, near Coleraine, to the Council, at a nominal rent, for the purpose of generating electricity for the district.

Dover.—Barrack Lighting.—The Town Council has arranged with the War Office to supply electricity to the Western Heights Barracks, which have hitherto been lighted by gas.

Electricity District.—Mid-Lancashire.—After discussing the future supply of electricity in Mid-Lancashire for 18 months, last week's Conference of Local Authorities was unable to devise a scheme satisfactory to all parties, and the conference has been adjourned *sine die*. The Electricity Commissioners have now asked for schemes to be prepared. It is not clear what will be the next step taken, whether local authorities will decide to act together or in part, or whether the Commissioners will come forward and submit a scheme of their own.

Glasgow.—Power in Docks.—At the Prince's Dock power station, progress is being made with the replacing of steam-driven pumps by direct-coupled turbine pumps. The transformer house is erected, and one electric turbine pump is already in operation. At Plantation Quay the steam-driven plant for pumping out dry docks is being replaced by electrically-driven pumps. A rotary converter has been installed for the supply of electric power and lighting on board vessels in the graving docks.

Halifax.—Extensions.—By taking in hand immediately schemes which had not been intended to be touched for some time to come, the Corporation Unemployment Committee hopes to provide work for about 500 men. The schemes concerned involve electricity and tramway work as well as work in the gas department, sewerage, and road widening. The work is to be carried on through the Borough Engineer's office.

India.—Ootacamund.—A meeting was recently held at the Municipal Office to consider the scheme put up by Mr. H. P. Gibbs for introducing electric power in advance of the Kunda scheme which has been held up owing to the state of the financial market. When the big scheme is carried out, power from it will be connected up with the distribution mains in Ootacamund, and the temporary plant dismantled. The majority of the municipal councillors of Ootacamund are reported to be strongly in favour of this scheme. The temporary plant will be steam-driven, for which the Municipal Council is in a position to command an abundant supply of fuel. Mr. Gibbs, on behalf of the Tata Engineering Co., inspected the Ootacamund area last year and worked out the preliminary details.

The work is estimated to cost approximately Rs. 3,60,000. The temporary plant will be put down by the Nilgiri Power Syndicate (which is about to be formed) consisting of Messrs. T. Stanes & Co., Coimbatore, Messrs. Tata & Sons, Ltd., of Bombay, Mr. G. Laird, manager for India of the Metropolitan-Vickers Co., London, Mr. C. Chetty, a prominent Indian gentleman of Coimbatore ,and Mr. H. P. Gibbs. The syndicate will carry on and complete all investigations and designs in connection with the Kunda project, and when the Nilgiri Power Co. is floated, the concession will be transferred to that company. The temporary plant will be erected in 18 months.—*Indian Textile Journal.*

Ilkley.—Government Plant.—A four-day trial run was made by the plant recently purchased from the Government. This is a 170-kW "Phœnix" generator direct coupled to a 225-h.p. "Garrett" superheated steam engine with condenser. The plant was unused, having been made for an aeroplane factory but never installed.

Keighley.—Loan Sanctioned.—The Electricity Commissioners have sanctioned the borrowing by the Corporation of £27,374, for electricity purposes. This is only part of the amount applied for, the balance of £26,252 being held over for further information.

Market Drayton.—Public Lighting.—The Urban District Council has accepted the tender of the Electric Light Co. for the lighting of 65 or more lamps during the period October 1st next to April 30th, 1922, from sunset to 10 p.m., at £4 10s. per lamp, subject to a reduction in the event of a fall in the cost of coal, &c.

Manchester.—Barton Station.—The new Barton power station is going to be an expensive project. Two years ago £1,810,500 was considered necessary for its construction, whereas now, the Electricity Committee is asking for power to borrow an extra sum of £1,466,743 to complete the scheme, thus bringing up the total to £3,277,243. The Finance Committee states that no charge will fall upon the revenues of the undertaking until such time as the generating station becomes revenue producing.

There was considerable criticism of this proposal at a meeting of the City Council last week. Councillor Judson said they were told the scheme would cost two million pounds, and now it was to cost another million and a half. Someone had blundered. Sir Edward Holt said the scheme should be put back for six months, in view of falling prices. Ald. Dagnall, chairman of the Electricity Committee, stated that two million pounds had already been spent, and it was not business to let that capital stand idle for another six months. Ald. West denied any blundering in the estimates, and said that no engineer in 1919 could correctly estimate the prices that would rule in 1921. The Council agreed to the borrowing of the amount.

Melbourne (Derbyshire).—Street Lighting.—The Urban District Council has accepted the tender of the Electric Light Co., for street lighting at £3 11s. per lamp, for four 300-watt lamps, and £1 9s. 3d. each for 63 ordinary lamps.

Monaghan.—Street Lighting.—The Monaghan Lighting Co. recently offered to light the town with 60 lamps at 10½d. per unit, and desired a guarantee that the Council would continue to take the light for seven years. To this the Council replied that it could only guarantee to take energy for two years, as it would go out of office in 1923. The company has replied that it can make no departure from its original proposal.

Motherwell.—Price Reduction.—The Town Council has decided to reduce the price of electricity for public lighting in the Wishaw area from 5d. to 3½d. per unit.

Nottingham.—Sub-station Site.—The difficulty of obtaining a site for the proposed sub-station in the Meadows district has been surmounted by taking over a piece of land at Bruce Grove, from the Public Libraries Committee.

Nelson.—Price Increase.—The Town Council has increased the charges for electricity for lighting by ½d. per kWh. and for power, by ½d.

Northwich.—District Extension.—The Electric Supply Co. has intimated to the Urban District Council its intention to apply to the Commissioners for a special order extending its district. The clerk has been instructed to report fully upon the matter to the General Purposes Committee.

Newport.—Loan.—The Corporation is applying for sanction to borrow £1,000 for the purchase of land for the extension of the East power station.

Oldham.—No Price Increase.—Owing to the depressed state of industry, the Electricity Committee has decided not to increase the charges for electricity as proposed.

Perth.—Extensions Approved.—The Electricity Commissioners have consented to the extension of the generating plant at the electricity station, at a cost of £15,000.

Peterborough.—Year's Working.—The 1920-21 accounts of the city's electricity undertaking (engineer: Mr. H. A. Nevill) record a total income of £25,452, as against £18,382 in the previous year. Working expenses totalled £22,057, as against £13,185, leaving a gross profit of £3,395 (£5,197). The net result was a loss of £3,580; there was a deficit of £688 in the preceding year. The number of units sold rose from 1,113,005 to 1,280,563.

Redditch.—Year's Working.—The accounts of the Council's electricity undertaking (engineer: Mr. R. N. Mayne) for the year ended March 31st last, show a total revenue of £34,638 as compared with £31,152 in 1919-1920. Expenditure on revenue account totalled £28,980, as against £22,796, leaving a gross balance of £5,658 (£8,356). The net result, after payment of all capital charges, was a deficit of £1,203, but this was covered by a balance of £13,169 brought forward, and £11,966 was carried forward to the next account. The preceding year's net result was a profit of £2,427. The number of units sold fell from 2,762,033 to 2,574,378.

Price Increase.—As from October 1st, the charges for electricity will be increased as follows: Lighting: factories, 7d. per unit, theatres, &c., 6d., and ordinary consumers, 8d. Power, cooking, and heating, 2½d. per unit, subject to decrease or increase with fluctuations in the price of coal.

Southport.—Extension of Supply.—The chairman of the Electricity Committee states that it is hoped to have the whole of the township of Ainsdale electrically lighted for the winter. It is hoped that the cables will be laid and the sub-stations completed by the end of the month. The work is being so carried out that should the Corporation at any time decide to take over the lighting of Birkdale, that business will be facilitated.

South Shields.—Price Reduction.—In view of the electricity undertaking having shown a profit of £16,438 during the past year, the Town Council has agreed to a 12½ per cent. reduction of charges.

Stafford.—New Scale of Charges.—The Town Council adopted on September 6th a new scale of tariffs for the Corporation electricity undertaking, with the object of popularising the use of electricity. The consulting engineer, Mr. Arthur Ellis, of Cardiff, in a report pointed out that the Corporation was committed to a very heavy additional capital expenditure, which it desired should become remunerative, and the undertaking self-supporting, at the earliest possible date. The present system of charging, he observed, was altogether inconsistent and, in his opinion, there was no justification whatsoever for its existence at all, it was not fixed upon any businesslike basis. The scale adopted by the Council provides for a flat rate of 8d. per kWh. consumed in the case of private residences—the minimum quarterly payment to be 7s. 6d., or alternatively at the request of the consumer 15 per cent. of the rateable value of the premises supplied, and in addition 2d. per kWh. consumed. In the case of hotels, shops, offices, and other business premises, a flat rate of 8d. per kWh. consumed is to be charged—the minimum quarterly payment to be 13s. 4d., or alternatively at the request of the consumer £2 10s. per kW per quarter of maximum demand, and in addition 2d. per unit consumed. The Electricity Committee proposed to charge 8d. per kWh. for lighting with a minimum quarterly payment of 7s. 6d. in the case of churches, but after discussion the Council agreed to fix the rate at 4d. per kWh. consumed, the same as for places of amusement. The rate for d.c. power supplies was fixed at £2 per kW per quarter of maximum demand, and in addition 1d. per unit consumed; for l.p. a.c. power supplies £2 per kVA per quarter of maximum demand, and in addition 1d. per unit consumed. In the case of factory and workshop lighting where the plant is electrically driven the consumer will be allowed to use 7½ per cent. of the total power consumption for lighting at power rates.

Swansea.—Year's Working.—The borough treasurer's abstract of accounts of the electricity undertaking for the year ended March 31st, together with the report of the electrical engineer (Mr. J. W. Burr), shows that the net income was £106,062, as compared with £77,329 for the previous year, and the working expenditure £80,199, or 75.62 per cent. of the income, as against £56,190, or 72.66 per cent. for the previous year. The gross profit amounted to £25,863, or 24.38 per cent. of income, as against £21,139 or 27.34 per cent. for the previous year; loan charges were £21,987, or 20.73 per cent., as against £16,733, or 21.64 per cent. for the previous year, leaving a net profit of £3,876, or 3.65 per cent. of income, as against £4,406, or 5.70 per cent., the previous year. The gross profit still represents over six per cent. upon the gross capital outlay, which the borough treasurer thought was very satisfactory. The net expenditure upon capital account during the year was £39,125, bringing the total expended up to £364,316 (excluding stock issue expenses). The total amount paid to date into the Reserve Fund, including interest, amounts to £29,389, of which £25,052 has been expended upon works which otherwise would have involved loans. The balance at the end of the year was £4,006.

The engineer's report on the 20th year of working, states, that the output of electrical energy from the works shows an increase of approximately 9 per cent., as compared with the previous year. The overall price per ton for coal for the year ended March last was £1 19s. 7d., as against £1 10s. 3d. for the previous year. An analysis of the working costs per unit for the year compared with the previous year shows: 0.69d. per kWh for coal, as against 0.52d.; oil waste, water, and stores, 0.05d., as against 0.01d.; wages, 0.30d., as against 0.21d.; repairs and maintenance, 0.34d., as against 0.26d.; rent, rates, and taxes, 0.10d., as against 0.12d.; management expenses and miscellaneous, 0.14d., as against 0.10d., making the totals 1.62d., as against 1.22d. The number of consumers connected to the mains during the year was 366. The highest number connected in any previous year was 261.

Wrexham.—Price Increase.—At a special meeting on September 6th the Town Council decided to abolish the 2½ per cent. discount, and to add 5 per cent. to the existing charges for electricity. It is hoped that by this means the loss of £2,000 incurred during the first part of the current financial year will be made good.

Walton-on-Naze.—Water Power.—The District Council is considering the utilisation of an old mill pond for the generation of electricity. It is stated that it would be possible to produce electricity to sell at 2d. per kWh.

York.—Bulk Supplies.—As a consequence of the special supply rates granted by the Corporation to Messrs. Rowntree and Co., a number of other large consumers have asked for supplies on similar terms. This has led the Corporation to consider supplying electricity in bulk. The North-Eastern Railway Co., is one of the applicants. The company already has an extensive plant of its own, but the *Yorkshire Herald* considers it possible that the whole of the company's needs may eventually be supplied by the Corporation if the terms are acceptable, and the company's own plant will be shut down. The adoption of the bulk supply scheme would, no doubt, entail considerable plant extensions.

TRAMWAY AND RAILWAY NOTES.

Bradford.—Year's Working.—The report of the general manager of the Corporation tramways (Mr. R. H. Wilkinson) for the year ended March 31st last, shows that the total revenue was £718,539, as compared with £608,991 in 1919-20. Working expenses amounted to £653,905, as against £501,534, leaving a gross profit of £64,636 (£107,457). After payment of all capital charges a net loss of £22,245 was the result. In the previous year the sum of £30,000 was contributed to the city fund in relief of rates. The number of car miles run increased from 5,648,370 to 6,347,404; the number of passengers carried rose from 86,469,014 to 88,865,557. The adverse financial result is attributed by the manager to the increased cost of labour and materials, and also to the institution of a holiday scheme for the men.

Reconstruction of Track.—The Tramways Committee recommends to the City Council that reconstruction of the tramway track be proceeded with on the Eccleshill section, from Idle Road to the terminus, at an estimated cost of £16,623, and on the Wyke section, near Odsal Top, at an estimated cost of £9,523. The Committee asks the Council to apply for power to borrow so much of these sums as would properly be met out of capital account having regard to the time which has elapsed since the existing track was laid.

A dispute has arisen between the Tramways Committee and the local branch of the United Vehicle Workers' Union in the matter of the recent discharge of a number of men who were taken on temporarily. The men discharged numbered 85, of whom 26 were reinstated; 19 obtained other work. The Tramways Committee, on being approached by the men's union, offered to take the men back on short time and pay for work done, but the union declined this, though it agreed to waive the guaranteed 48 hours' week in the case of these particular men, if they were reinstated on a 24 hours' agreement subject to the usual service conditions. The Committee was unable to promise the usual conditions of service, with the "privileges" of such service, and said that their employment must be accepted as temporary.

Continental.—Sweden.—The Swedish State Railway administration, referring to the proposed electrification of the railway between Stockholm and Gothenborg, states that the two committees which are engaged on the examination of the question of the system to be adopted and the measures to be taken to prevent disturbances being set up in telegraph and telephone lines, are expected to complete their reports by the end of this year, when it will be possible to start the work of conversion. The expenditure on the whole scheme, including the electric locomotives, has been considerably reduced, from the former estimate of 105,000,000 kr. to about 65,000,000 kr. As the value of the steam locomotives which will be set free through the electrification can now be reckoned at 22,500,000 kr., the entire cost of undertaking the work will be only 42,500,000 kr. As a consequence the estimate of 23,000,000 kr. already sanctioned represents slightly over one half of the total calculated outlay, and no further grant will be required in 1922 if the work of electrification is started during that year.

Norway.—Included in the recent Norwegian Budget is a sum of 2,500,000 kr. for the electrification of the Ofoten Railway.

Darlington.—Accident.—An electric tramcar and a motor wagon were proceeding in the same direction in Parkgate, last week, when the wagon, overtaking the car, drew in front too suddenly, and the tramcar driver's platform was smashed and the windows of the car broken. No personal injury resulted and the car was capable of returning to the depôt under its own power.

Glasgow.—Ticket Economy.—In a letter to the *Daily Mail* it is pointed out that the Corporation makes a yearly profit of over £800 on used tramway tickets. Boxes are fixed above the footboard into which passengers drop their tickets as they alight. It is an offence to throw used tramway tickets into the street.

Gosforth Park.—Light Railway.—At a meeting of the Newcastle-on-Tyne City Council on the 7th inst., the agreements with the High Gosforth Park Co., Ltd., and the Tyneside Tramways and Tramroads Co., as to the light railway through Gosforth Park, were submitted.

Ald. R. Mayne, in moving that they be approved, said under the agreement with the Park Co. the Corporation obtained a perpetual easement for practically 1¼ miles of double track through the park without any capital payment, and also a right to lay an additional 200 yards of single-line siding. The method of construction of the railway was subject to the approval of the company's architects, subject to a right of arbitration in case of difference. In return the Corporation would pay one-third of the net profits upon cars run over the railway after deducting all capital charges and working costs. The agreement with the Tyneside Tramways Co. simply carried out the arrangement already approved. Under it the Corporation was prohibited from extending the light railway northward, or alongside the North Road; and the Corporation undertook, if the Tyneside Co., desired, to put in two junctions between the Corporation tramways in Benton Road, where the Tyneside lines crossed the road and intersected the Corporation tramways. The agreements were approved.

Java.—Railway Electrification.—The authorities of the Dutch East Indies State Railways have decided on the electrification of the Batavia-Weltevreden and Buitenzorg-Tandjong Priok lines.

London.—New L.C.C. Cars.—In about eight weeks' time deliveries of the new L.C.C. tramcars, 125 of which were ordered in June, will begin, says the *Evening News*. These will have many improvements as compared with the present cars, and will be faster than any of the present tramcars. There will be seats for 78 passengers, and those in the vestibule on the top of the car will be rearranged to give more knee room. Greatly improved lighting is also promised, and the ceilings upstairs and down will be painted white. The new cars are to cost approximately £4,000 each.

Tube Breakdown.—Four trucks, part of a repair train whose crew was taking up the under-river line of the City and South London Railway and relaying it by night, became derailed and jammed soon after 2 a.m. on September 9th. One of the trucks sank into the line bed and could not be moved for some time, so that the whole of the under-river section of the line had to be closed.

On October 9th and following Sundays it is intended to reopen all stations on the Underground electric railway system for the whole day with the exception of Cannon Street, Covent Garden, York Road, and Aldwych stations.

Maidstone.—Year's Working.—The annual report of the Light Railways Committee for the year ended March 31st last shows that the total revenue of the tramways was £25,478, and working expenses £21,253, leaving a gross balance of £4,365. The payment of capital charges resulted in a net deficit of £123.

Salford.—Strike.—On Sunday last, at midnight, the employés of the Corporation tramway department ceased work as a protest against the secession of a number of inspectors and clerks from the United Vehicle Workers' Union. As a relief measure the Corporation has started running charabancs.

Southport.—Extension of Time.—The Minister of Transport has extended the time until August, 1922, of the Southport Corporation Act, 1913, for the completion of the electrical equipment for the working of trolley vehicles.

York.—Short-time Wages.—A recent decision of the Tramway Committee not to accede to an application for full bonus for tramway employés during the time they were working short-time owing to the coal strike, has been reconsidered by the Traffic Committee, and a report is to be made.

TELEGRAPH AND TELEPHONE NOTES.

China.—Telephone Developments.—Extensive telephone improvements and extensions, embracing both long-distance and local services, are under way in Kiangsu Province, but will not be fully completed for some time. It is planned to connect all important cities in the Province by long-distance services. Connections between Shanghai and Nanking will probably be completed by the end of 1921. The total cost of the changes now being effected in the Province will amount to approximately $1,000,000, of which $425,000 will be expended in the city of Nanking in a complete reorganisation of the local system, including $100,000 for new buildings, $150,000 for interior, and $150,000 for exterior equipment. It is understood that the exterior materials are being purchased through the Sino-Japanese Electric Co., and the interior from a Chinese-American company. The service between Nanking and Pukow, located across the Yangtze river, is also being extended. The submarine cable with only two wires, which now connects these two cities, will be replaced by a new cable providing for 26 wires, which it is thought will meet all requirements at present and in the near future.—*Eastern Engineering.*

Czecho-Slovakia.—Telephone Extensions.—In less than two years the telephone lines in Czecho-Slovakia have been increased by 6,250 miles.—*The Times.*

France.—Accident at Wireless Station.—It is reported that one of the masts of the La Doua wireless station, on the outskirts of Lyons, collapsed on September 10th, killing one and injuring another man.—*Reuter's Trade Service* (Lyons).

Germany. — Wireless Telephony. — According to the *Deutsche Allgemeine Zeitung*, highly successful experiments in wireless telephony have recently been carried out between Berlin and Copenhagen.—*Reuter's Trade Service* (Berlin).

Greece.—New Telegraph Service.—Direct telegraphic communication between Athens and Broussa (in Asia Minor, 57 miles south-south-east of Constantinople) has been established, says the *Daily Mail*.

Italy.—Wireless Telegraphy.—The first meeting of the Commission recently nominated by the Associazione Elettrotecnica Italiana to study questions related to telegraphy, telephony, and radiotelegraphy was held in July, when the use of wireless telegraphy by industrial companies possessing electric plant was discussed as one among several means of extending the employment of wireless telegraphy generally. In Italy hitherto wireless telegraphy has been limited to the naval and military services and to a few shipping concerns. To carry out the Association's plans, three sub-committees have been appointed, whose duty will be to find out the machines best suited for wireless purposes, to fix standards for the various parts, to ascertain what dielectric rigidity is required, to settle the earth insulations of dynamos and transformers, the choice of a direct-current type of machine able to work with sudden and frequent changes of load, the tendency of short-circuiting and sparking at the collector, the insulation of conductors, protection against lightning, safeguarding of neighbouring networks against disturbance, &c. Also an attempt will be made to induce the Government to extend the teaching of wireless telegraphy in all polytechnic and technical schools, to appoint those fitted to grant certificates, and what prerogatives these will confer on the recipients. The most delicate part of the sub-committees' task will be to advise on the steps to be taken to induce the State to relinquish its monopoly and to throw open unrestrictedly wireless telegraphy to private firms. This is the only course, it is contended, that will serve for the proper development of wireless telegraphy in Italy. The question, however, bristles with so many difficulties that it was decided to reserve its consideration for a future meeting, when absent members of the Association would be present.

Press Telegrams.—The Postmaster-General announces that on and from September 15th, Press telegrams at the reduced rate for Italy will be accepted at post offices, on the usual conditions, between 6 p.m. and 12 noon.

Telephone Extensions.—The Italian official journal has published the text of laws providing for an extraordinary expenditure of 166,000,000 lire for the improvement of the telephone and telegraph networks.

Russia.—New Wireless Station.—A large wireless telegraph station is being erected near Moscow, says the *Daily Mail*; the purpose of the Russian People's Commissariat of Posts and Telegraphs being to install apparatus that will enable Moscow to speak simultaneously to every place on the face of the earth. The apparatus is being made in the big radio laboratory and works at Nijni-Novgorod, under the supervision of a band of Russian scientists. During Russia's recent years of isolation her radio progress has been remarkable. Most of the experts are not Bolsheviks, but are enthusiasts for research and eager to develop the possibilities of wireless. Russia is covered by an efficient network of 597 wireless stations (about six times as many as in the British Isles), which keep Moscow in instantaneous touch with what is going on all over the country and in Siberia and Turkestan.

The Telephone Service.—Storm Damage.—During the night of September 11th-12th a thunder storm did considerable damage to the telephone system; over 2,500 lines were "down" in London alone, and to add to the trouble a water main burst at Tottenham, causing some damage by the flooding of cables.

In Tottenham alone 178 subscribers' lines and 235 junctions were out of operation. By Tuesday evening, however, 2,258 lines in the London area had been restored.

Strenuous efforts are being made by the Post Office to complete the system of underground telephone cables, but according to the *Daily Chronicle*, laying an underground wire in towns is an expensive process. Recently, in London, one 1,000 ft. long was laid to relieve the Avenue Exchange, and it cost over £3,000.

Revenue.—Statistics published in the *London Gazette* show that the estimate of Post Office revenue for the year 1921-22 was £60,000,000, while five months' actual business had yielded only £18,500,000, suggesting at this rate a deficit on the year of £15,600,000. The increase during the five months over the corresponding period of last year is only £250,000. The figures represent revenue paid into the Exchequer, but not total revenue. One important point is that there has been a change in telephone accounting, whereby accounts are rendered quarterly instead of monthly. The figures, therefore, do not include full telephone receipts, which will be given in late returns.—*Daily Telegraph.*

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared.)*

OPEN.

Argentina.—October 21st. State Railways. Twelve months' supply of electrical stores.*

The Commercial Secretary to H.M.'s Legation at Buenos Aires states that the State Railways invite tenders to be presented early in November for one year's supply of railway signal material, including telephone and telegraph materials, &c. Specifications, tender forms, &c., are expected to arrive early in October, and will be available in the Inquiry Room of the Department of Overseas Trade, 35, Old Queen Street, Westminster, S.W.1.

Australia.—Melbourne. Victorian Government Railways. October 26th. D.c. arc welding plant (Cont. No. 34,377). Armature banding machine with electric motor and starting gear (Cont. 34,378).*November 2nd. Electric storage battery complete for automatic telephone exchange (Cont. 34,229).*

January 4th. Victorian Government Railways. 150 electric train stops operated by a single-phase induction motor. One set of electric pyrometer equipment for measuring temperatures of 350 to 2,000 degrees Fahrenheit.—*Reuter's Trade Service* (Melbourne).

Adelaide.—October 12th. Postmaster-General's Department. 2,750 yds. telephone cords, 120 hand sets, 160 jacks.*

Belfast. — September 19th. Electricity Department. E.h.p. and l.p. switchgear for the new harbour power station. (See this issue.)

Brighton.—September 20th. Board of Guardians. Electrical fittings, &c., for three months. H. Burfield, Clerk, Prince's Street.

Bulgaria.—Sofia.—October 7th. Department of Posts and Telegraphs, 100,000 porcelain insulators.*

Eastbourne.—September 26th. Electricity Department. One water-tube boiler, fan and chimney, boiler-feed pump and piping; one 2,500-kW turbo-alternator with condensing plant and pipework. (September 2nd.)

Fort William.—September 17th. Electric lighting in connection with 12 houses. Particulars from Mr. J. G. Falconer, architect, Fort William.

Glasgow.—Tenders for lighting North Woodside Road lodging house by electricity are to be asked for by the Corporation.

London.—Bermondsey.—September 23rd. Board of Guardians. Six months' supply of electric lamps. Mr. H. Reeve, clerk to the Guardians, 283, Tooley Street, S.E.

Morocco.—September 19th. Post and Telegraph authorities at Rabat, 86 tons of copper wire 3 mm. diameter.

Nottingham.—October 21st. Electricity Department. Three 10,000-kW turbo-alternators with exciters, condensers, auxiliary plant, &c. One 1,000-kW combined turbo-generator-alternator with condenser, auxiliary plant, &c. Six water-tube boilers with mechanical stokers, superheaters, forced draught fans, &c. (See this issue.)

New Zealand.—Wellington.—November 29th. Public Works Department, Mangahao electric power scheme: three water wheels, three 6,000-kVA and two 3,000-kVA a.c. generators, two 3-unit exciter sets, seven 4,000-kVA, single-phase transformers, insulators, lightning arresters, switchboard, &c.*

October 15th. Corporation. Two water-tube boilers with feed-water heaters, superheaters, stokers, &c.; one 5,000-kW turbo-alternator with condensing plant. (September 2nd.)

Portsmouth.—September 21st. Board of Guardians. Electrical fittings, for three months. Mr. E. H. Mitchell, clerk, St. Michael's Road.

South Africa.—Johannesburg. November 7th. Rand Water Board. Two 350-kW steam-driven electrical generating sets, complete with switchboards and all accessories.*

Uxbridge.—Board of Guardians. Tenders for converting the electric power plant at the Institution, Hillingdon, from 100 V d.c. to 200 V single-phase, 50 periods, and supplying machinery for same. (September 9th.)

Warrington.—September 27th. Board of Guardians. Electrical goods for three months. Mr. A. Bottomley, Bewsey Chambers.

Worksop.—Urban District Council Electricity Department. Supply and erection of an overhead transmission line, complete with underground connecting cables, distance approx. 2,200 yds., pressure 6,600 V. (See this issue.)

*** A copy of the specification, &c., can be consulted at the Department of Overseas Trade, 35, Old Queen Street, S.W. 1.**

CLOSED.

Barking.—Electricity Committee:—

Electric light installation, New School Buildings, £265.—Lund Bros.

Bradford.—Electricity Committee. Plant at Valley Road works.

Water supply pipes for No. 4 boiler house.—Stanton Ironworks Co., Ltd.
Steel piers for supporting pipes to No. 9 and No. 10 cooling towers.—H. Barrett & Sons, Ltd.
Switchboard for No. 4 boiler house and extension to switchboard for transformer chamber.—Bertram Thomas.
Electric side-tipping truck.—Electromobiles, Ltd.
Automatic centrifugal sump pump.—Holden & Brook, Ltd.

Crewe.—Accepted:—

Electric light installation, Linden Grange and Maternity Home, £150.—Carrington & Button.

Darwen.—Corporation. Accepted:—

For the installation of telephones connecting the various departments.—Mr. W. V. Fairhurst.

Glasgow.—Corporation. Recommended:—

Electric main for transformer to exhauster house at Provan Gas Works.—Callender's Cable Co., Ltd.
Circulating condensing water at gas works for three months.—McFarlane Engineering Co.

Corporation. Accepted:—

Electric lighting of Mount Blow House and Avenue, £173.—Johnston, Park and Co.

Newcastle-on-Tyne.—City Council.

4,000-kW turbo-alternator and surface condensing plant for the Manors Station, £33,700.—C. A. Parsons & Co., Ltd.

FORTHCOMING EVENTS.

Institution of Production Engineers.—Saturday, September 17th. At the Institution of Mechanical Engineers, Storey's Gate, S.W. At 7 p.m. Paper on "The Manufacture of Ball and Roller Bearings," by Mr. J. D. Scaife.

Ideal Homes Exhibition.—Monday, September 19th, to Saturday, October 8th. At the Kelvin Hall, Glasgow.

NOTES.

Stage Lighting.—Science has already done much in the way of stage effects; however, it still holds in reserve wonders even more startling than those we know of. On September 9th, for instance, a private view was given at the London Hippodrome of a development in the domain of electric lighting which, granting it can be economically applied, should, it is claimed, go far to solve the problem of how to accomplish an instantaneous and complete change from one scene to another. The novelty is the work of Adrian Samoiloff, a young Russian.

The illusions, he declares, are produced by the use of light rays, of many shades, coming from all parts of the stage and controlled and blended by a tiny instrument invented by himself. The device is to become a standing feature at the Hippodrome in "The Peep Show," in a short series of scenes to be called "The Valley of Echoes." The public will thus be enabled to judge for themselves of the effects it is capable of accomplishing.

Finsbury Technical College Old Students' Association.—The annual general meeting of the above association was held at Finsbury Technical College on September 5th, the president, Professor G. T. Morgan, O.B.E., D.Sc., F.R.S., occupying the chair. A report was read of the progress made since the association was resuscitated in the early part of 1920, and reference was made to the great success of the dinner and smoking concert held last season.

The fact that the college is being kept open, owing in no small measure to the efforts of old students of the college, should impress on all old students the necessity of the association, and should ensure a steady influx of new members. Students who have recently completed their course will be well advised to apply for membership at once if they have not already done so.

The annual dinner this year has been arranged for Saturday, November 12th, and the smoking concert for Friday, January 27th, both these functions being held at the newly opened Engineers Club. The first number of a *Bulletin*, which it is proposed to issue quarterly, is in course of preparation and all old students are requested to forward immediately an account of what they are now doing for inclusion therein. Application forms for membership and all particulars of the association may be obtained from the Hon. Secretary, Mr. H. P. Guy, 209, Northumberland Park, Tottenham, N.17.

Educational.—Northampton Polytechnic Institute.—For the full-time courses in engineering and technical optics a special entrance examination is to be held at the end of September. The 1921-22 session opens on October 3rd for day courses; evening classes commence on September 26th. A volume of "Announcements—Educational and Social" has been issued, and this gives full details of all subjects included in the numerous courses as well as particulars of the social and recreative side of the Institution.

The Polytechnic, Regent Street, W. 1.—A special course of lectures on "Cost Accounts" will be delivered by Mr. R. G. Legge on Fridays, commencing September 30th. Full particulars are given in our advertisement pages to-day.

Manchester University.—The Faculty of Technology has issued its prospectus for session 1921-22. Full details as to times and subjects are given for the various courses. These courses include mechanical, electrical, and municipal and sanitary engineering, and many branches of applied chemistry. The first term of the session (Michaelmas) opens on October 6th. Other particulars given are scales of fees and general information regarding graduation, &c.

Battersea Polytechnic Institute.—The next session commences for day courses on September 27th, and evening courses on September 26th (enrolment commences September 20th). An abridged calendar of evening classes can be obtained gratis on application to the principal.

Appointment Vacant.—Electrical engineering draughtsman (£150 + war bonus), for the Metropolitan Asylums Board.

Fatality.—An inquiry was held on the 7th inst. into the cause of the death of Frank Edward Plum, an electrician at Messrs. Armstrong, Whitworth & Co.'s naval yard at Walker-on-Tyne. On September 1st, it was stated, he was instructed to cut away some loose cables which were "dead," and it was while doing this work in the sub-station that he was killed. After the accident it was found that there were plier marks on a live conductor, showing that deceased had attempted to cut it in error. The pressure was 255 volts. Plum was an efficient man, and had been responsible for the maintenance of all the electrically-driven plant at the south end of the yard.

New X-ray Process.—An important scientific discovery will, according to the daily Press, be disclosed at the annual exhibition of the Royal Photographic Society this month. The discovery is reported to be the outcome of researches carried out by the Society, and will, it is claimed, enable operators to take a photograph of the object showing, not only what it is, but also "its exact location, depth, and position." It is also said that the new process will considerably reduce the risk of X-ray dermatitis. Several other discoveries will be shown, one of which is in connection with autochrome photography, making it possible to take coloured pictures.

Bread Baking by Electricity.—The loaves which won the first prize for white bread at the Armstrong Gardens Association's annual show at Heaton, Newcastle, were baked in an electric oven. The prize-winner was Mrs. J. J. Watson, who used the oven of her ordinary electric cooking range to bake the bread. A success like this in an open competition substantiates the claim that electricity is a most efficient method of cooking, combined with absolute cleanliness and economy.—*Newcastle Daily Journal.*

INSTITUTION NOTES.

Institution of Electrical Engineers.—London Students' Section.—With the return to more normal conditions the London Students' Section has had a very active session. A full account of the meetings, visits, and social functions is detailed in the committee's report for the 1920-21 session, during which eleven general meetings and the annual general meeting were held at the various technical colleges in London. The average attendance was 39, the highest recorded being 75. The opening address to the Section was delivered by Mr. C. C. Patterson, O.B.E., and by invitation of the Graduates' Association of the Institution of Mechanical Engineers a joint meeting of the London Students' Section and the above Association was held on November 8th at the Institution of Mechanical Engineers. In response to this, members of the Graduates' Association were invited to the I.E.E. Students' meeting on December 3rd. During the year eleven visits were paid to various works, and five social functions were held during the session. The revival of the summer tour for the Section was greatly appreciated by students; the visit to Glasgow was arranged for the week commencing July 25th, 1920, and the programme included meetings, visits, &c. As the tour to the Glasgow district proved a great success, the committee decided to make more ambitious plans for this summer. Arrangements for a tour in Switzerland are now practically completed, and it is expected that a large number of students will be present.

On the occasion of the visit to the works of Messrs. Everett, Edgcumbe & Co., Ltd., on February 11th, 1921, Major Edgcumbe very kindly offered two prizes for the best description of the works. The first prize, value £2 2s., was awarded to Mr. H. S. Petch, and the second, value £1 1s., to Mr. F. La L. T. Budgett.

The Council is to make a grant to the London Students' Section to cover the expenses of publishing advanced abstracts of students' papers for distribution to students before or at the meetings. The grant will cover the cost of producing about twelve such abstracts per annum. The Students' Section has also been very fortunate in having several of its papers published in the B.E.A.M.A. *Journal.*

Faraday Society.—A general discussion of "Catalysis, with Special Reference to newer Theories of Chemical Action," will be held on September 28th at the Institution of Electrical Engineers. Tickets of admission from the Secretary of the Faraday Society, 10, Essex Street, London, W.C.2.

Manchester Association of Engineers.—The Association has just issued a booklet setting forth the objects of the Students' Section. These appear to be the usual aims of an engineering society, viz., the improvement of members' professional knowledge by the reading and discussion of papers on subjects connected with their work.

Wireless Society.—The Glasgow and District Radio Club, which is affiliated with the Wireless Society of London, held its first "field day" on August 20th in Bellahouston Park, Glasgow; it was a great success, as were also the other meetings which were held during the past session. The 1921-22 session will commence with the annual general meeting on September 28th.

Birmingham and District Electric Club.—The opening meeting of the winter session was held at the Grand Hotel on September 10th. A paper was read by Mr. Norman Deykin on his recent experiences in Canada. The lecturer gave an interesting and enjoyable account of the many cities, towns, and natural scenery of the great Dominion, giving much information about Canadian electrical development and practice.

Institution of Production Engineers.—A general meeting of the Institution will be held on Saturday, September 17th, at the Institution of Mechanical Engineers, at 7 p.m. Mr. J. D. Scaife will deliver a paper on "The Manufacture of Ball and Roller Bearings," illustrated by lantern slides.

National Association of Supervising Electricians.—On Tuesday last a meeting was held at St. Bride's Institute, at which the new president, Major T. Vincent Smith, M.C., delivered his inaugural address.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the comercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

We heartily congratulate Sir Philip Dawson, M.P., on the result of the Lewisham Parliamentary election. Sir Philip received 9,427 votes, the other candidates following with 8,580 and 6,211 votes respectively.

Mr. J. Y. Mackersie, A.M.I.E.E., resident engineer at the Summer Lane power station of the Birmingham Corporation Electric Supply Department, is leaving this month to take up an important electrical appointment in Calcutta. On 6th inst. he was presented with a canteen cabinet from the technical staff, by the chief engineer, Mr. R. A. Chattock. Mr. Mackersie has been held in the highest esteem during the past 15 years by the Birmingham staff, a large number of whom assembled to wish him success in his new sphere in India.

With reference to our note of last week with regard to his claim against the Edinburgh Corporation for loss of office due to the amalgamation of Leith with Edinburgh, Mr. A. Peden Rutherford informs us that no award has yet been issued.

Mr. T. L. Rogers has recently left the service of the English Electric Co., Ltd. He has had an exceptionally lengthy connection with the electrical industry. He joined the old Anglo-American Brush Electric Light Corporation in 1883, and continued the connection until 1908, when, on the advent of the tantalum lamp, he joined Messrs. Siemens Bros. Dynamo Works, Ltd., which was taken over by the English Electric Co. in March last.

Mr. Geoffrey C. Jagger, who has for some years past held the post of chief draughtsman with Medway's Safety Lift Co., Ltd., has joined the Titan Lift Co., Ltd., of 20, High Holborn, W.C. 1, as chief engineer.

Mr. R. H. Willis, M.I.E.E., owing to illness and the need of a long rest, has resigned his position as manager of the Manchester office of Messrs. Crompton & Co., Ltd. His address is 24, Darley Avenue, West Didsbury, Manchester.

Obituary.—Mr. B. Newgass.—The death took place on Thursday last week, at Frant, Sussex, of Mr. Benjamin Newgass, aged 83, of Messrs. B. Newgass & Co., merchants, Gracechurch Street. He was a director of the Yorkshire (West Riding) Tramways Co., Ltd., and of the San Luco (Mexico) Tramways and various other companies.

Sir Salter Pyne.—We regret to record the death, which occurred at Exmouth last week at the age of 61 years, of Sir Salter Pyne, who as an engineer went to Afghanistan in 1885 and took up an appointment at Kabul in the service of the Ameer. The Ameer entrusted to Sir Salter very extensive engineering operations and industrial enterprises for the good of the country, and the deceased gentleman became a personage of great importance in the Ameer's councils.

NEW COMPANIES REGISTERED.

Myriad Display Co., Ltd. (176,630).—Private company. Registered September 5th. Capital £1,500 in 1,000 preference shares of £1 each and 10,000 ordinary shares of 1s. each. To acquire and turn to account certain patents for improvements in lamp shades, particularly applicable for advertising or decorative purposes, and to adopt an agreement with W. J. Raine. The subscribers (each with one share) are: W. J. Raine, 11, Gerrard Street, W.1, artist; T. A. C. Eady, 3, Hedden Street, Regent Street, W.1, manufacturing jeweller. The permanent directors are: W. J. Raine, T. A. C. Eady, C. H. A. Edye and G. F. Joseph. Registered office: 11, Gerrard Street, W.1.

British Automatic Telephone Installation Co., Ltd. (176,608).—Private company. Registered September 3rd. Capital £10,000 in £1 shares. To carry on, maintain, and work, so far as they lawfully can or may, private or other telephones or telegraphs, &c. The permanent directors are: G. W. Tempest, 59, Rugby Road, Brighton (managing director); G. C. Tideman, 20, Tritton Road, West Dulwich, S.E. (chairman); J. Hunter, Bethany, Ballyholme Road, Bangor, Co. Down; A. Channing, 21, Vesey Place, Kingstown, Ireland. Qualification, £250. Registered office: 82, Victoria Street, S.W.

Meridian Electric Co., Ltd. (11,856).—Private company. Registered in Edinburgh September 6th. Capital, £4,000 in £1 shares (3,900 ordinary and 100 deferred). To carry on the business of electrical engineers, factors, sheet ironworkers, mechanical and general engineers, iron and brass founders, copper and tin smiths, plumbers, millwrights, &c. The first directors are: G. R. Jamieson, Richmond House, Bo'ness, electrical engineer; A. Haggie, 183, Meadowpark Street, Glasgow, electrical engineer. Qualification, 100 shares. Registered office: 29, Renfrew Street, Glasgow.

Clear Hooters, Ltd. (176,641).—Private company. Registered September 6th. Capital, £5,000 in £1 shares (3,000 participating cumulative preference). To carry on the business of manufacturers of, agents for, and dealers in electric motor and other horns and hooters, electrical, mechanical and other signalling devices, sparking plugs, and general motor and other accessories, &c. The first directors are: W. A. Crosbie, Abbey Hotel, Malvern; J. H. Mills, The Green, Castle Bromwich; W. J. Spicer, The Spinney, Mount Lane, Monkspath, Shirley, Birmingham; T. S. Rogers, 25, Edmund Road, Saltley, Birmingham (all permanent). Secretary: T. S. Rogers. Registered office: Hooterland, Highgate Square, Camp Hill, Birmingham.

Portham Separators, Ltd. (176,698).—Private company. Registered September 8th. Capital, £5,000 in 5s. shares. To acquire and turn to account any invention relating to the use and application of steam separators or apparatus, and to carry on the business of mechanical, electrical, motor car, textile or woodworking engineers, boiler and pipe makers, &c. The subscribers (each with one share) are: W. L. Waite, 28, Wallingford Avenue, North Kensington, W., clerk; A. H. Hawthorn, 4c, Sutton Dwellings, James Street, Bethnal Green, E.2, clerk. The subscribers are to appoint the first directors. Qualification, £1 share. Remuneration as fixed by the company. Solicitors: Nicholson, Graham and Jones, 24, Coleman Street, E.C.

Richard Whiffen, Ltd. (176,605).—Private company. Registered September 2nd. Capital, £15,000 in £1 shares. To take over the business carried on by R. G. Whiffen and R. Attwater at Excelsior Works, Carriage Street, Old Trafford, Manchester, as Richard Whiffen, and to carry on the business of electric insulation, india-rubber, asbestos, gutta-percha, flax, hose, flax and cotton belting, and ship and engineers' stores manufacturers, &c. The first directors are: R. G. Whiffen, 186, Stamford Street, Old Trafford, Manchester; R. Attwater, Carleton House, Lower Bank Road, Fulwood, Preston (both permanent governing directors, subject to holding 1,000 shares). Remuneration of R. G. Whiffen as governing director shall, whilst he devotes the whole of his time and attention to the company's business, be £1,000 per annum, or 50 per cent. of the net profits, whichever is greater. Registered office: Excelsior Works, Carriage Street, Old Trafford, Manchester.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Monometer Manufacturing Co. (1918), Ltd.—Particulars of £8,000 debentures authorised September 30th, 1921;; whole amount issued; charged on company's property, present and future, including uncalled capital.

Russels (Manchester), Ltd.—Particulars of £12,000 and of £8,000 debentures authorised September 30th, 1921; whole amount issued; charged on the company's undertaking and property, present and future, including uncalled capital.

D. Hulett & Co., Ltd. (169,979).—Return dated August 11th, 1921. Capital, £5,000 in £1 shares. 4,420 shares taken up. £320 paid. £4,100 considered as paid. Mortgages and charges, nil.

Tudor Accumulator Co., Ltd. (54,080).—Return dated July 21st, 1921. Capital, £100,000 in £10 shares (8,800 "A" and 1,200 "B"). All shares taken up. £29,000 paid (being £10 per share on 2,600 "A" and £2 10s. on 1,200 "A.") £71,000 considered as paid (being £10 per share on 1,200 "B" and 5,000 "A" and £7 10s. on 1,200 "A.") Mortgages and charges: Day-to-day bank overdraft not exceeding £50,000.

CITY NOTES.

German Companies.

The Brandenburg Carbid und Elektrizitats Werke A.G., of Berlin, reports net profits of 807,000 marks for 1920-21, as against 325,000 marks in the preceding year, and dividends at the rate of 10 and 7 per cent. in the two years respectively.

The directors of the *Elektra A.G.*, of Dresden, report that a further improvement in the working results of the supply works and tramways in which the company is interested took place in 1920-21. After making provision for depreciation, the accounts show net profits of 726,000 marks, as against 288,000 marks in the previous year, and the dividend rises from 5 per cent. in 1919-20 to 6 per cent. last year on a larger share capital.

The accounts of the *Isaria Zähler Werke A.G.*, of Munich, makers of meters, and closely associated with the Swiss Brown, Boveri & Co., show net profits of 7,897,000 marks for 1920-21, as compared with 1,778,000 marks in the preceding year. It is proposed to pay a dividend and bonus of 40 per cent. on share capital of 11,000,000 marks, being the same rate as in 1919-20, on capital of 2,750,000 marks. The report states that exceptional profits on exchange were obtained in the export business.

French Companies.

The report of the *Société des Ateliers de Constructions Electriques du Nord et de l'Est* (Jeumont) for last year shows a net profit of 4,619,912 fr. It is proposed to distribute this as follows: 5 per cent. (230,572 fr.) to legal reserve, 153,846 fr. to the directors, 923,078 fr. to the preference shareholders, 3,300,090 fr. to the ordinary shareholders, and to carry forward 12,386 fr. The directors in their report state that the works may now be said to have been entirely reconstituted after the war, and that the productive capacity is greater than before the hostilities. So far they have not been affected by the industrial crisis. Although the orders on hand will keep the works going for some considerable time, a slight falling off in new demands has, however, been experienced. In view of the many railway electrification schemes at present projected in France, a proposal that the concern should be amalgamated with the Société des Forges et Ateliers de la Longueville is to be submitted to the shareholders.

The Compagnie Continentale Edison, of Paris, reports a loss of 65,565 fr. for the last financial year, reducing the credit balance in the balance sheet to 60,505 fr.

The accounts of the *Compagnie Francaise des Cables Telegraphiques* for 1920 are reported to show net profits of 10,991,000 fr., as compared with 6,596,000 fr. in 1919. In the latter year the dividend was at the rate of 28.63 fr. per ordinary share, and an increase is expected for 1920.

Stock Exchange Notices.—The undermentioned have been ordered to be officially quoted:—

Melbourne Electric Supply Co.—£37,451 consolidated ordinary stock and 30,000 8 per cent. first cumulative preference shares of £5 each, fully paid (Nos. 1 to 10,000 and 80,001 to 100,000.)

Application has been made to the Committee to allow the following to be officially quoted:—

Pernambuco Tramways and Power Co., £500,000 eight per cent. Prior Lien Debentures, Nos. 1 to 5,000 of £100 each (bearer).

Dundee, Broughty Ferry & District Tramway Co.—The profit for the year ended July 31st, including £309 brought forward, was £6,682, less interest on debenture stock £1,199. Dividend on ordinary shares at the rate of 7 per cent. per annum, less tax, to reserve £1,500. Carry forward £474.

Still Engine Co., Ltd.—According to the *Financier*, the balance sheet of this company at March 31st, 1921, shows issued capital of £220,000; sundry creditors and credit balances, £1,209; total, £221,209. Credit: Goodwill, patents, and other assets acquired, £154,074; plant and machinery, £10,102; furniture, £1,000; stores, £1,080; experimental and research expenditure, £23,251; head office expenses, after deducting deposit interest, discount on Treasury bills and transfer fees, £6,469; preliminary and formation expenses, £3,126; underwriting commission, £3,750; sundry debtors and debit balances, £1,069; Treasury bills, at cost, £9,850; cash at banks and in hand, £7,438; total, £221,209. According to the same contemporary, the company is about to create £75,000 8 per cent. debentures, redeemable in 12 years at 110 per cent. Part will shortly be issued to shareholders at par.

Austria.—The report of the A.E.G. Union Electrizitäts Gesellschaft, of Vienna, for last year shows a profit of no less than 13,540,000 kr. as compared with only 2,210,000 kr. in the preceding 12 months. The dividend is being increased from 8 per cent. on a capital of 24,000,000 kr. to 12 per cent. on 100,000,000 kr. The directors also propose that the capital should be again increased to 225,000,000 kr.

British Aluminium Co., Ltd.—A dividend at the rate of 5 per cent. per annum, less tax, on ordinary shares for the six months ended June 30th.

New Issues.—*Messrs. Lazard* have purchased debenture stock from the Newcastle-upon-Tyne Electric Supply Co. (£633,109 4½ per cent. first mortgage and £100,000 5 per cent. second), and are offering this to the public at 73.

The financial Press states that a block of £130,000 5½ per cent. debenture stock of the *Yorkshire Electric Power Co.* has just been privately placed.

Sir W. G. Armstrong, Whitworth & Co., Ltd.—Interim dividend on ordinary of 6d. per share, less tax, and usual dividends on preference.

Stewarts & Lloyds, Ltd.—Interim dividends for the half-year ended June 30th, at the rate of 6 per cent. per annum, on the preference at the rate of 10 per cent. per annum, on the preferred ordinary.

Globe Telegraph and Trust, Ltd.—Quarterly interim dividend of 3s. per share on preference, less tax, and 5s. per share on ordinary.

Eastern Extension, Australasia & China Telegraph Co., Ltd.—Interim dividend for the quarter ended June, 5s. per share free of tax.

Eastern Telegraph Co., Ltd.—Dividend at the rate of 3½ per cent. per annum, less tax for the quarter ending September, on the preference stock, and a second quarterly dividend of 2½ per cent. on the ordinary stock free of tax.

Western Telegraph Co., Ltd.—Dividend of 5s. per share, making a total of 10 per cent. free of tax, for the year ended June 1921.

Browett, Lindley & Co., Ltd.—Interim dividends of 6 per cent. on the preference shares and 4 per cent. on the ordinary, less tax, are announced in the *Financier*.

Lancashire Dynamo & Motor Co., Ltd.—Interim dividend of 9d. per share, tax free, on ordinary.

Clarke, Chapman & Co., Ltd.—An interim dividend of 5 per cent., less tax, is announced on the ordinary shares.

Mackay Companies.—A dividend of 1½ per cent., less tax, for the quarter is announced.

STOCKS AND SHARES.

Tuesday Evening.

The latest impediment thrown across the path of Stock Exchange business is the renewed slump in the value of the German mark and the French franc. The movements occurred simultaneously. The slump in the value of the marks, which has made them worth 20 to a shilling, is declared traceable to the latest payment of German indemnity. One indirect result is the fact that, with the mark about 400 to the pound, German manufacturers are able to quote prices for electrical machinery, &c., at levels which greatly under-cut those asked by British manufacturers. Several of the big users of machinery have notified their intention of waiting until British prices come down before they make the purchases which should assist the employment of British workmen, but those to whom prices are an immediate object are placing orders in Germany now.

Shares in the electrical manufacturing companies are not much influenced one way or the other by such trade developments. Some of the stocks and shares are, indeed, a little better. Edisons have risen 1s. 6d. to 7s. 6d. Electric Construction Debenture at 52 is 2 points up; Metropolitan-Vickers Preference at 1 13/16 have recovered the half-crown which they shed last month. General Electrics and other similar shares keep fairly steady, and there is still a good demand for well-secured debenture and sound preference issues.

North Metropolitan Electric and Metropolitan Electric Debenture stocks are both 8½ premium. Thames Valley Electric Power 6 per cent. Debentures have improved to 1½ premium, and the similar Southland Electric Debentures—both these issues are guaranteed by the New Zealand Government—stand better at 1½ premium. The General Electric new debenture stock has gone back to 97—the cumulative dividend price. Amongst engineering issues, Baldwin 7½ per cent. debentures, which came out at 95, have risen to 1½ premium. The iron, coal and steel group shows a disposition to dulness, owing to several disappointing dividends which have recently been declared. Armstrongs, for instance, have announced an interim dividend of 6d., as against the 1s. per share this time last year. The price is accordingly a little lower at 18s. There is some talk of the company having secured a huge contract which will provide work for a couple of years. This may be merely gossip, but the steadiness of the price suggests that there may be something in the rumour. Babcock & Wilcox drooped to 2 7/16.

Electricity supply issues are again a good market. In fact, it is difficult to get the offer of stock. People who want to buy such shares as County of London Electrics, for instance, will find themselves met with the report that jobbers are buyers only, and have no shares to offer. The same state of affairs obtains in a number of shares in this market. City of London ordinary, however, can still be bought about 28s. 9d. A demand for Bournemouth & Poole ordinary discovered the market bare of stock. The shares have not changed hands for five months, and the last recorded deal took place at 5½, the 4½ per cent. preference shares having been done a month earlier at 5½. This last is still the nominal quotation of the shares, but, as with the ordinary, there are none to be obtained. Westminsters were done at the end of last week at £5 18s., and Metropolitans are up ½ to 4.

A further issue of Newcastle-upon-Tyne Electric Supply debenture stocks, of both classes, is being offered at 73. Yorkshire Electric Power 5½ per cent. debenture is now quoted ex the dividend payable in October, and the price is 83 free of stamp and fee. At this, the return comes to £6 12s. 6d. to the buyer, or, allowing for redemption in 1944 at par, the yield is raised to just over 7 per cent. on the money. English Electric 8 per cent. six-year Notes are offered at 97, giving a return of 8¼ per cent. flat. These are redeemable in 1927 at 103, or after 1923 at the same price. Calcutta Electric Supply 5 per cent. 1st mortgage convertible debenture stock can be bought at 98. The return at this price is £5 2s. 6d. per cent. net, the interest being paid free of tax. The right of conversion entitles holders of the debenture stock to exchange £5 of this security for £7 10s. in ordinary shares between June, 1922, and June, 1925. The present price of the ordinary shares is 21s. 3d., so the conversion has no value for the time being.

Amongst the few preference shares on offer may be mentioned Notting Hill 6 per cent. non-cumulative £10 shares at 7¼, with dividends in January and July, affording 8 per cent. on the money. Indian Electric Supply 7 per cent. non-cumulative preference at 16s. 6d. return 8½ per cent., and General Electric 7½ per cent. "B" preference at 18s. 9d. yield 8 per cent., which is 11s. 6d. per cent. more than the return at the present price on the company's 6½ per cent. "A" preference shares. There are a few Charing Cross, West End 4½ per cent. preference offered at 3, which pay 7½ per cent. on the money, the dividends being due in February and August.

Owing to the manner in which the New York exchange has moved, there is a good deal of inquiry for securities the coupons on which are payable in London and New York. Most of the Mexican utility bonds are eligible in this respect. For instance, the coupons on Mexico Tramway Fives are payable in London, New York, Canada, Berlin and Switzerland. The Mexican Light & Power coupons can be cashed in London, New York and Canada, and the same applies to the 5 per cent. first mortgage gold bonds of the Mexican Electric Light Co. Rio Tramway bonds of both classes, San Paulo Tramway fives and Shawinigan Water & Power issues are amongst those carrying coupons which can be cashed in London or Canada, several of them being payable also in New York. It need hardly be pointed out that the Mexican companies have only just resumed payment of interest after an abstention of about seven years. The feature amongst foreign stocks is the way in which Brazilian Tractions are recovering. The price has risen to 30½, and the demand appears to come from New York and Paris. The last dividend the company paid was in March, 1917, but the 6 per cent. cumulative preference shares have received their dividends throughout, and at the present price of 76½—the coupons being payable quarterly in London and Canada—the return works out to £7 16s. 6d. per cent. on the money.

Globe Telegraph ordinary shares at 16½ have arrived at the same level as Eastern Extension shares, while Eastern ordinary at 163½ is a point up. Marconis, after touching 1 15/16, went back to 1½, which still leaves them 1/16 higher on the week. United River Plate Telephones at 6 are ¼ down. The Anglo-American list is steady, and other cable stocks and shares show little variation, except that some of the dollar stocks are better on balance.

Districts at 17 are ¼ down, and Underground Electric Incomes at 75½ show a fall of a point, the railway market as a whole being drab and uninteresting. No improvement has occurred in the rubber share market, where conditions continue to fight against the producer. The latest burden which certain of the companies are called upon to bear is the imposition of heavy fresh taxation in the Dutch East Indies.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1919.	Dividend 1920.	Price Sept. 13, 1921.	Rise or fall.	Yield, p.c.
Home Electricity Companies.					
Brompton Ordinary	12	12	6⅝	—	£9 8 3
Charing Cross Ordinary	7	8	4½	—	9 8 4
do. do. do. 4½ Pref.	4½	4½	3⅝	—	7 4 4
Chelsea	4	6	3½	—	9 4 8
City of London	13	14	13	—	10 3 9
do. do. 6 per cent. Pref.	6	6	17/6	+6d.	6 17 3
County of London	8	8	9½	+ ½	8 15 4
do. do. 6 per cent. Pref.	6	6	8⅜	—	7 7 4
Kensington Ordinary	7	9	4⅜	—	10 18 4
London Electric	¾	¾	1	—	7 10 0
do. do. 6 per cent. Pref.	6	6	2⅝	—	10 9 6
Metropolitan	6	7	4	+ ¼	8 15 0
do. 4½ per cent. Pref.	4½	4½	3⅛	—	7 16 0
St. James' and Pall Mall	12	12	6½	—	9 4 8
South London	6	7	3⅝	—	10 18 3
South Metropolitan Pref.	7	7	15/9	—	8 17 10
Westminster Ordinary	10	10	5½	—	8 18 10
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	86	—	6 19 6
do. Def.	1½	1½	17½	—	8 14 2
Chile Telephone	6	6	5½	—	5 14 3
Cuba Sub. Ord.	7	7	7½	—	9 6 8
Eastern Extension	10	10	16½	+ ½	6 1 0
Eastern Tel. Ord.	10	10	163¾	+ 1	6 2 4
Globe Tel. and T. Ord.	10	10	16½	+ ½	6 1 0
do. do. Pref.	6	6	9⅜	—	6 6 4
Great Northern Tel.	23	24	25½	+ ½	9 10 0
Indo-European	10	10	80	—	8 6 8
Marconi	25	15	1⅞	+ 1/16	8 0 0
Oriental Telephone Ord.	13	13	2 1/16	—	*5 16 3
United R. Plate Tel.	8	8	6	— ¼	*6 13 4
West India and Panama	Nil	Nil	6/8	—	Nil.
Western Telegraph	10	10	16½	—	*6 1 2
Home Rails.					
Central London Ord. Assented	4	4	47½	—	8 8 6
Metropolitan	1½	1½	25	— ½	6 0 0
do. District	Nil	Nil	17	— ½	Nil
Underground Electric Ordinary	Nil	Nil	2½	—	Nil
do. do. "A"	Nil	Nil	6/6	—	Nil
do. do. Income	4	3	75½	—1	*3 19 5
Foreign Trams, &c.					
Anglo-Arg. Trams, First Pref.	5½	12½	3⅜	—	10 0 0
do. do. 2nd Pref.	Nil	5½	2½	—	10 0 0
do. do. 5 % Deb.	5	5	83½	— ½	7 17
Brazil Tractions	Nil	Nil	30½	+1½	Nil
British Columbia Elec. Ry. Pfcs.	5	5	60	—	8 6 8
do. do. Preferred	5	98/-	55½	—	*8 11 2
do. do. Deferred	3	124/-	56	—	*11 3 2
do. do. Deb.	4½	4½	59¾	—	7 2 10
Mexico Trams 5 per cent. Bonds	Nil	Nil	69	+1	—
do. 6 per cent. Bonds	Nil	Nil	25	—	Nil
Mexican Light Common	Nil	Nil	9	—	Nil
do. Pref.	Nil	Nil	16½	—1	Nil
do. 1st Bonds	Nil	5	48½	—1	10 6 0
Manufacturing Companies.					
Babcock & Wilcox	15	15	2 7/16	— 1/16	6 11 2
British Aluminium Ord.	10	10	17/6	—	11 8 6
British Insulated Ord.	15	15	1⅝	—	9 12 0
Callenders	15	15	1⅞	—	10 8 8
„ 6½ Pref.	6½	6½	18/9	—	6 18 8
Crompton Ord.	10	10	14/6	—	13 15 10
Edison-Swan	10	—	7/6	+1/6	—
do. do. 5 per cent. Deb.	5	5	68	—	7 7 1
Electric Construction	10	10	18/9	—	11 18 10
English Electric	8	8	11/-	—	14 11 0
Do. Pref.	6	6	14/-	—	8 11 6
Gen. Elec. Pref.	6¾	6¾	17/6	—	7 8 7
do. Ord.	10	10	90/-	—	10 0 0
Henley	15	15	1⅝	—	10 5 0
do. 4½ Pref.	4½	4½	6½	—	6 18 6
India-Rubber	10	—	2½	—	—
Met.-Vickers Pref.	8	8	1 13/16	—	8 16 10
Siemens Ord.	10	10	1⅞	—	*8 18 2
Telegraph Con.	99	99	21½	—	*5 18 1

* Dividends paid free of Income Tax.

THE BRITISH ASSOCIATION.—II.

On Wednesday afternoon, the 7th inst., prior to the inaugural meeting, Dr. E. J. Russell, F.R.S., of the Rothamsted Experimental Station, delivered a lecture to an audience of farmers and agricultural students upon "Science and Crop Production." The chemical aspect of the question was dealt with very fully, but only a passing mention was made of the use of high-pressure electrical discharges for the improvement of production; the names of Miss Dudgeon and Prof. V. H. Blackman were mentioned in this connection.

An extremely large gathering at the Usher Hall in the evening heard with regret that, owing to indisposition, the President was unable to be present. Prof. W. A. Herdman, the retiring president, spoke of his satisfaction in appearing for a short time as President of the Association in his native city of Edinburgh, and briefly outlined the achievements of his successor, Sir Edward Thorpe, making special reference to the "Magnetic Survey of the British Isles," which he carried out with Sir Arthur Rucker (a former president) just prior to 1896. Sir Alfred Ewing, Vice-President, then read Sir Edward Thorpe's address. The reading ended, Lord Provost Hutchison moved a vote of thanks to the President and welcomed the Association to the city. Sir James Dewar seconded the vote, and Sir Alfred Ewing briefly responded.

A record of the Association's proceedings would be incomplete without mention of the valuable handbook issued to members. This is entitled "Edinburgh's Place in Scientific Progress"; it deals with all branches of science, and is an excellent record of the contributions of many famous Scotsmen to the advancement of knowledge. The mathematical section is particularly interesting, as it shows the connection of Edinburgh, through Michael Scot, the "Wizard," with science in the early days—the twelfth century. A number of portraits are included—the frontispiece being a likeness of the famous John Napier, the discoverer of the logarithmic function and the inventor of logarithms. The part devoted to engineering touches upon the works and inventions of such men as Nasmyth and Robert Stephenson. The volume is well worth the six shillings charged for it.

On Thursday the heavy programme of meetings in each section was commenced. The addition of two or three papers to the Physics Section's list caused congestion, and Mr. Campbell Swinton's paper (abstracted in our last issue) was read rather later than arranged. In this section business was resumed in the afternoon, when Mr. J. J. Dowling demonstrated a recording ultramicrometer, and Dr. Dawson Turner and Mr. Crombie conducted experiments with a pith ball in ionised atmospheres. In Section B—Chemistry, Dr. M. O. Forster, F.R.S., delivered his presidential address on "The Laboratory of the Living Organism." Sections F—Economics, J—Psychology, and L—Education, combined in a discussion upon "Vocational Training and Tests." Among the visits and excursions arranged for Thursday afternoon was an inspection of Messrs. Bruce Peebles' works at Granton Road. About two dozen members of the Engineering Section availed themselves of the opportunity, and members of the firm's staff conducted the visitors and gave a great deal of information. The power-house was first inspected, and there was seen the firm's original steam-driven d.c. plant running in parallel with a converter dealing with power from the Edinburgh Corporation's mains. The building-up of various types of machines was studied, and the visitors watched with interest the processes of coil-winding, commutator building, the stamping of laminations for poles and rotor cores, and the multitudinous other operations involved in this class of work. The visitors were shown two large shearing machines, capable of dealing with 1½-in. steel plates, one purely hydraulic and the other half hydraulic and half electric. A machine for forming boiler tubes was also seen. Upon the conclusion of the visit, Prof. Bacon, on behalf of the Association, thanked Messrs. Bruce Peebles and the guides of the party for a very instructive afternoon. In the evening the Lord Provost, Magistrates, and Council of the city held a reception at the Royal Scottish Museum.

The business of Section G on Friday morning was devoted exclusively to the study of water-power development and its problems. The President's address, which gave a very good idea of the potentialities both in the British Empire and outside it, is abstracted below. Prof. Baily dealt with the utilisation of very small water-power sources, and developed a scheme for linking these up to aid a large steam-driven central station, a system which would receive power from the central station in times of water shortage. Prof. Lea, who could not secure time to read his paper fully, confined his attention almost wholly to a study of the Severn scheme, giving a number of curves plotted from personal observations of the action of the tides in the estuary. It was found impossible to discuss these papers, as the morning had been fully taken up, but the President reiterated the appeal made, both in his own address and by the two later speakers, for the establishment of a special department or laboratory for the exclusive study of the proper utilisation of water power. The address of Prof. Richardson to the members of Section A—Physics, was acclaimed as a masterly exposition of the present state of the science of thermionic emission and its concomitants. Sir Oliver Lodge, in proposing a vote of thanks to the President, showed the bearing of thermionic emission on the differences of various authorities upon the question of contact electricity, giving examples of the action between pairs of dissimilar metals such as copper and zinc and bismuth and antimony. Sir Dugald Clerk seconded the vote, and spoke of the importance of the study of thermionic emission to the engineer, mentioning the views of Joule and Kelvin upon the subject of contact electricity.

In Section F—Economics, the morning was occupied by the reading and the discussion of Mr. Hichens's address. The discussion was opened by Mr. Austen Hopkinson, M.P., who gave it as his opinion that industrial arbitration was as futile as international arbitration. He thought that the Whitley principle was wrong in that it pre-supposed an existing conflict between capital and labour when such was not the case. These were not absolutely separate entities; their interests were bound up with one another. He spoke of his experience in connection with a profit-sharing scheme, stating that the employés concerned wished the business to be extended, but were told that the money which might have been used for this purpose had been distributed among them. The employés were not willing, of course, to find the funds themselves. Mr. H. F. G. Burgess, speaking from the employés' point of view, acknowledged the difficulty of fixing a standard wage in any industry. It seemed to him that a standard wage was one agreed upon after a conflict between employers and employed. This speaker caused some amusement by suggesting a standard wage for employers, adding that they should be made to earn it. Mr. Arnold Lupton said that arbitration was very often a failure, and instanced the case of a firm which had accepted a wages award made by a Whitley Council but had found itself unable to pay it, and as a consequence had had to shut down. Sir William Beverley urged greater publicity regarding profits, not necessarily those of individual firms, but principally those of whole industries. Lady Martin appealed for the better education of workers in the principles of economics. Section F also had a busy afternoon, when Mrs. B. Wootton read a paper on "Self-supporting Industries: an Inquiry into the Principle of Regulating Wages and Provision against Unemployment in Accordance with Industrial Capacity"; Prof. A. W. Kirkaldy spoke on "The Wages System and Possible Developments"; and Sir

Josiah Stamp, K.B.E., dealt with "The Taxable Capacity of a Country." The visits made by the various sections on Friday afternoon included a trip to the Brunton Wire Mills by Section G, and members of Section A went to the Royal Observatory. On Friday evening, Prof. C. E. Inglis described the construction of the Forth and Quebec Bridges, and the evolution of cantilever bridge construction, in the Usher Hall.

Notes on Water Power Development.

PRESIDENTIAL ADDRESS, BY PROF. A. H. GIBSON, D.Sc.

(Abstract.)

Section G.—Engineering.

THE extent to which the water powers of the world have been investigated and developed during the past decade forms one of the striking engineering features of the period; two-thirds of the water power at present in use has been developed within the last ten years. The technical development of electric generation and transmission has made it economically possible to utilise powers remote from any industrial centre, while a rapid increase in the demand for energy for general industrial purposes, combined with the world shortage of fuel, has been responsible for an unprecedented rate of development in most countries with available water power resources, and especially in countries normally dependent on imported fuel. Thus in France some 850,000 water h.p. has been put into commission since 1915, and the country now has 1,600,000 h.p. under control, as compared with 750,000 before the war. In Switzerland some 600,000 h.p. has been developed since 1914, or is in course of development, as compared with 880,000 h.p. before the war. In Spain, where the pre-war output was 150,000 h.p., the present output is 620,000 h.p., and about 260,000 h.p. is now in course of development, while the Ministerio de Fomento is considering the development of some 2,000,000 h.p. to be delivered into a network of transmission lines covering the industrial parts of the country. In Italy, schemes totalling about 300,000 h.p. are under way, and it is estimated that the total output will shortly amount to 2,000,000 h.p. Japan, which only very recently began to investigate her water powers, has, since 1916, developed over 1,000,000 h.p., or almost 20 per cent. of her available resources. In Canada and the United States many large schemes have recently been brought into service, and some extremely large installations are now in course of construction or are projected. In Canada the total development (2.3 million h.p.) in 1918 was almost three times as great as in 1910. In the United States of America the development has increased from something under two million h.p. in 1901, to 5.3 millions in 1908, and to nearly 10.0 millions in 1920.

Estimates of potential power are always to be accepted with considerable reserve, as there is as yet no standard basis on which potential power is computed. Estimates of potential power based on storage capacity are subject to a wide margin of error owing to the limited data available, and in a table given in the paper the potential water power is estimated on the basis of the maximum flow, and in terms of continuous 24-hour power. Adopting the figures in the table, it would appear that the available horse-power of the world is of the order of two hundred millions, of which approximately 25 millions is at present developed or is in course of development. With the noteworthy exceptions of Canada and New Zealand, practically nothing had been done, prior to 1915, by any part of the British Empire, to develop or even systematically to investigate the possibilities of developing its water powers. The Water-power Committee of the Conjoint Board of Scientific Societies has come to the conclusion that the total available water power resources of the Empire are equivalent to between 50 and 70 million h.p. Of the developed power in the Empire about 80 per cent. is in Canada. Throughout the remainder of its territories only about 700,000 h.p. is as yet developed, or only a little over 1 per cent. of the power available, a figure which compares with about 24 per cent. for the whole of Europe, and 21 per cent. for North America, including Canada and the U.S.A.

The Board of Trade Water Power Resources Committee, appointed in 1918, has carried out preliminary surveys of as many of the more promising sites as its limited funds allowed. As might be anticipated, Scotland possesses relatively greater possibilities than the remainder of the United Kingdom. Nine schemes examined by the Committee have an average output ranging from 7,000 to 40,000 continuous 24-hour h.p., and an aggregate capacity of 183,000 h.p. The aggregate output of the Scottish schemes is roughly 270,000 continuous h.p. It is probable that there are water-power sites in the country capable of developing the equivalent of 400,000 continuous h.p., or 1,500,000 h.p. over a normal working week. Owing to the general flatness of the gradients, there are, except possibly around Dartmoor, no schemes of any large individual magnitude in England, but there are a large number of powers ranging from 100 to 1,000 h.p. which might be developed from river flow uncontrolled by storage. Investigations on a few typical watersheds throughout England and Wales appear to show that the possible output averages approximately eight continuous horse-power per square mile of catchment area, which would be equivalent to an aggregate of about 450,000 h.p.

In the report recently issued by the Irish Sub-committee of the Board of Trade Water-power Committee, it is estimated that approximately 500,000 continuous 24-hour h.p. is commercially available in Ireland. The capacity of the fuel power plants installed for industrial and public utility services in the United Kingdom in 1907 was approximately 9.8 million h.p. Allowing for an increase of 15 per cent. since then, and an average load factor of 35 per cent., this is equivalent to 32,000 million h.p.-hours per annum, or to a continuous 24-hour output of only 3.7 million h.p. According to Sir Dugald Clerk, the average consumption of coal per h.p.-hour in this country is about 3.9 lb., which, on the above basis, would involve a total annual consumption of 55 million tons for industrial purposes, not including railways or steamships. It thus appears that the inland water power resources of the United Kingdom are capable of supplying about 27 per cent. of this.

There is a probability that two of the larger schemes in Scotland will be developed in the near future. One of these —the Lochaber scheme—is capable of developing some 72,000 continuous h.p., which is to be utilised largely in the manufacture of aluminium. The second—the scheme of the Grampian Power Co.—is intended ultimately to develop upwards of 40,000 continuous h.p., which it is proposed to use largely for general industrial purposes. In view of their direct and indirect advantage to the community it would appear not unreasonable to advocate that financial assistance should be granted by the State in the earlier stages of such developments.

The consumption of coal in the best modern steam plant of large size, giving continuous output, would be about nine tons per h.p.-year, and on this basis the world's available water power if utilised would be equivalent to some 1,800,000,000 tons of coal per annum. The world's output of coal in 1913 was approximately 1,200,000,000 tons, of which about 500,000,000 tons were used for industrial power purposes, so that on this basis 55,000,000 continuous water h.p. would be equivalent to the world's industrial power at that date. While a large proportion of the energy developed from water power is utilised for industrial purposes and for lighting, power, and traction, an increasing proportion is being used for electrochemical and electrometallurgical processes. The electrification, on a large scale, of trunk line railways is also a probability in the not distant future. In the U.S.A. 650 miles of the main line of the Chicago, Milwaukee, and St. Paul Railway, comprising 850 miles of track, has been electrified, the power for operation being obtained from hydro-electric stations. In France much of the track of the Compagnie du Midi has been electrified with the aid of water power; much of the Swiss railway system has been electrified; and the electrification of many other trunk lines on the European continent is at present under consideration. Much energy is now being utilised in the U.S.A. for purely agricultural purposes.

The large amount of attention which has been concentrated on the various aspects of water power development during the past ten years has been responsible for great improvements such as increasing the size, capacity, reliability, and efficiency of individual units; of improving the design of the turbine setting and of the head and tail works; of increasing the rotative speed of low head turbines; of detailed modifications in the reaction type of turbine to enable it to operate under higher heads than have hitherto been considered feasible; and of increasing the transmission voltage. One of the great drawbacks of the low-head turbine in the past has been its relatively low speed of rotation, which necessitated either a low-speed, and consequently costly, generator, or expensive gearing. As a result of experiment it has, however, been possible so to modify the form of the runner as greatly to increase the speed of rotation under a given head without seriously reducing the efficiency. Until comparatively recently the Pelton wheel was looked upon as the only practicable turbine for high heads, and the use of the Francis turbine was restricted to heads below about 400 ft. In the earlier Francis turbines, when operating under heads involving high speeds of water flow, corrosion of the runner was very serious. A newly-constructed hydro-electric plant has often to compete in the market with a steam plant built in pre-war days, whose standing charges are comparatively low, and in order to enable it to do so with success the constructional cost must often be reduced to a minimum compatible with safe and efficient operation. There appears to be ample scope for investigation into the possibility of reducing the first cost by modifying many of the details of design and methods of construction now in common use, *e.g.*, by the elimination of the dam in storage schemes in which natural lochs or reservoirs are utilised, this water level being drawn down in times of drought instead of being raised in times of flood; the substitution, where feasible, of rockfill dams for those of masonry or monolithic concrete; the introduction of outdoor installations with the minimum of power house construction; and the simplification of the power plant. Among the many questions still requiring investigation on the civil and mechanical sides may be mentioned: Investigation of turbine corrosion; bucket design in low-head high-speed turbines; questions affecting the design of canals and tunnels; methods of construction of dams; and run-off data.

While such data may be obtained either from stream gaugings or from rainfall and evaporation records, the former method is by far the more reliable. Useful results would

follow the initiation of a systematic scheme of gauging applied to all streams affording potential power sites. Among other questions which are ripe for investigation may be mentioned: The combined operation of steam and water-power plants; the relative advantages of high voltage d.c. and a.c. generation and transmission for short distances; and the operation of automatic and semi-automatic generating stations.

The question of tidal power has received much attention during the last few years. Many suggestions for utilising the tides by the use of current motors, float-operated air compressors, and the like have been made, but the only practicable means of utilising tidal energy on any large scale would appear to involve the provision of one or more dams, impounding the water in tidal basins, and the use of the impounded water to drive turbines. If some electrochemical or electrophysical process were available, capable of utilising an intermittent energy supply subject to variations, the value of tidal power would be greatly increased. Various schemes have been suggested for obtaining a continuous output by the co-ordinated operation of two or more tidal basins separated from each other and from the sea by dams with appropriate sluice gates. This method, however, can only get over the difficulty of equalising the outputs of spring and neap tides if it be arranged that the maximum rate of output is that governed by the working head at the lowest neap tide, in which case only a small fraction of the available energy is utilised. Among the hydraulic, mechanical, and electrical problems involved may be mentioned: The most advantageous cycle of operations as regards working periods, mean head, and variations of head; the best form of turbine; the best method of operation; constant or variable speed; whether the generators shall be geared or direct driven; and whether generated power shall be direct or alternating current.

A research laboratory is required with facilities for experiments on the flow of water on a fairly large scale; for carrying out turbine tests on models of sufficient capacity to serve as a basis for design; and, if possible, working in conjunction with one or more of the hydro-electric stations already in existence. As a result of representations made by the Water Power Committee of the Board of Health, it is understood that it has now been decided to initiate a Chair of Hydro-Electric Engineering in some university.

Long-distance Transmission of Electrical Energy with Special Reference to Tidal Power.

By T. F. Wall, D.Sc., &c. (*Abstract.*)

Section G.—Engineering.

Introductory.—The utilisation of tidal power for the generation of electricity involves a peculiar and difficult problem arising from the extremely large variation of speed of the turbines under the varying head of water.

According to the reports appearing in the Press, the proposals of the Ministry of Transport for the Severn scheme provide for an average development of 500,000 h.p. over a 10-hour day. The scheme involves the use of special d.c. generators driven by water turbines, these generators being so designed that each machine will develop about 1,300 kW at a constant pressure of 525 V, and at a speed varying from 300 to 500 r.p.m. The d.c. so generated would then be supplied to rotary converters giving a.c. at 320 V, and by means of static transformers this pressure would be raised to 60,000 V, which would be the pressure of transmission to the Midlands. Transmission to London—a distance of 115 miles—is suggested, at a pressure of 120,000 V.

Owing to the varying speed of the turbines, the use of a.c. generators driven by the turbines is, in the ordinary way, not practicable, since the generated e.m.f. would be of varying frequency—viz., for the speed range given above, the maximum value of the frequency would be 1.66 times the minimum value. Moreover, unless elaborate automatic arrangements were made, the generated e.m.f. would also vary

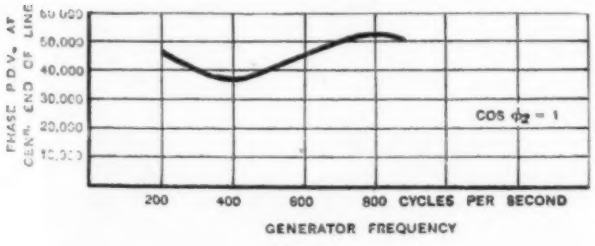


Fig. 1.

in magnitude more or less in proportion with the speed variation.

Such large variations of frequency and e.m.f. would be impracticable for feeding a distribution system, for the obvious reasons that motors, such as induction or synchronous motors, would have similar speed variations independently of the requirements of the consumer, and lighting and heating appliances could not be operated from a system the pressure of which widely varied.

It is clear that the proposal to generate 500,000 h.p. by means of 1,300 kW d.c. sets, and then to convert to a.c. by means of rotary converters, would involve an immense number of machines. The duplication of machines necessary owing to the generation in the first instance as d.c., and then conversion to a.c., is a very serious matter, and the capital outlay for these machines alone would probably be sufficiently large to imperil the feasibility of the scheme.

The purpose of the paper is to give very briefly a preliminary outline of an alternative system obviating the difficulty of the varying speeds of the turbines. The system permits of the use of a.c. generators driven directly from the turbines, and it is expected that an appreciable saving in capital outlay will result. The system also presents other advantageous features.

Briefly stated, the scheme involves the generation of a.c. at such a frequency that the length of the transmission line at one turbine speed (viz., the lowest) will be equal or approximately equal to one-quarter the wave length of the travelling waves of p.d. and current which will be established in the line. As the speed of the turbines increases, so will the frequency of the generated a.c. increase correspondingly, and if the excitation is constant, the generated e.m.f. will also increase correspondingly. As the frequency increases, the wave length decreases, so that, if at the lowest speed the length of the line is one-quarter wave length, then at double

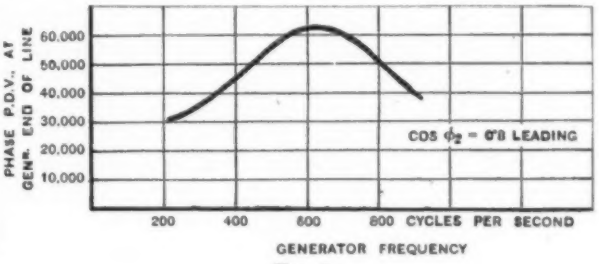


Fig. 2.

this speed the length of the line will be one-half wave length. Assuming constant current at the receiving end of the line, it is shown that, notwithstanding the rise of the generator voltage as the speed rises, the voltage at the receiver's end of the line will remain constant. The arrangements thus result in an a.c. supply, at the receiver's end of the line, of constant voltage and variable frequency.*

So long as the p.d. is constant and the frequency is high, a variable frequency is not objectionable for heating and lighting apparatus. In order to obtain a supply suitable for driving motors, &c., it is proposed to obtain d.c. by means of mercury arc rectifiers, and it is shown that, by such means, a constant a.c. voltage of variable frequency, generated and transmitted in the manner already described, may be transformed to a d.c. supply of constant current and very approximately constant voltage.

Generation and Transmission.

The author develops a number of equations expressing the relationships between line constants and the voltage and current vectors at the receiving and generating ends of the line respectively, for quarter-, half-, and three-eighth-wave length conditions. An actual example is worked out for the three conditions, and the results are summarised in the curves (figs. 1, 2, and 3), which show the phase p.d. which is necessary at the generator end of the line in order that the phase p.d. at the receiver's end of the line shall remain constant with varying generator frequency. In each case it is assumed that the load at the receiver's end of the line is constant and equal to 15,000 kW.

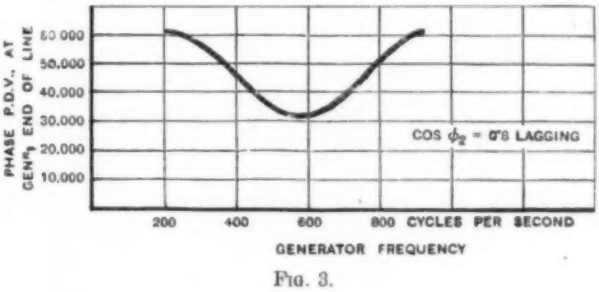


Fig. 3.

Fig. 1 shows the conditions for unity power factor at the receiver's end of the line, that is, cos $\phi_2 = 1$; line current = 96 A. Fig. 2 shows the conditions for cos $\phi_2 = 0.8$ leading; line current = 120 A. Fig. 3 shows the conditions for cos $\phi_2 = 0.8$ lagging; line current = 120 A.

* The principles of quarter-wave and half-wave transmission were explained in the Electrical Review of August 13th, 1920, and following issues.

Mercury Arc Rectification at the Receiver's End of the Line.

Assuming that the rectified load per phase is 5,000 kW, viz., 2,500 A at 2,000 V, and assuming values for the reactance and resistance of the rectifier circuit and load, the following values have been calculated for the p.d. which is necessary at the secondary terminals of the transformer to which the rectifier is connected. The calculations are based on the assumption that the d.c. voltage and current are kept constant at the values given above.

Frequency of the a.c. supplied to the Rectifier.	P.D. at the secondary terminal of the transformer to which the Rectifier is connected.
300 cycles per second	5,900 volts
400 cycles per second	5,500 volts
600 cycles per second	5,650 volts

It thus appears that for 100 per cent. variation in the frequency, viz., from 400 to 800 cycles per second, it is only necessary that the p.d. should vary by 7 per cent. in order that the rectified current and pressure should remain constant.

As already stated, for lighting and heating purposes it would not be necessary to rectify the variable frequency alternating current. If the voltage drop with increase of frequency were troublesome in the distribution system, this could be compensated for by allowing the voltage at the receiver's end of the line to rise by a definite percentage as the frequency increased instead of maintaining this voltage constant.

It will be observed that the proposals put forward involve the existence of a consumers' load of constant magnitude. If a large industrial area is supplied, such constancy of load is not difficult to obtain and, by the establishment of electrochemical and metallurgical industries in or near the areas supplied, a practically constant load could be ensured. The extremely good load factor so obtained would ensure practically ideal conditions as regards minimum cost of supply.

THE CENTRIFUGAL PURIFICATION OF OIL.

The De Laval Method of Treating Lubricating and Transformer Oils.

It has long been known that centrifugal force has the same effect as gravity, many times multiplied, and that by its use liquids of different specific gravities are readily separated, and solid impurities can be removed. Besides being very much more speedy than the ordinary methods of gravity settlement and filtration, the action of centrifugal force is much more positive and results in the line of demarcation between the purified liquid and the waste matter being more clearly defined.

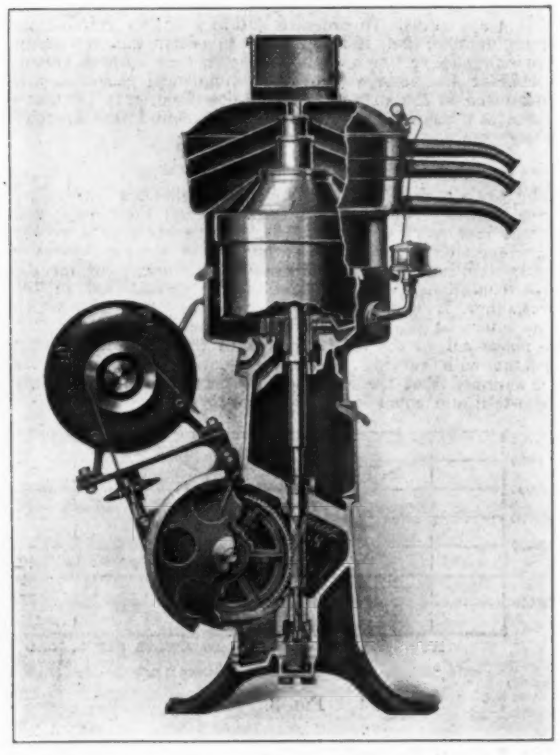


Fig. 1.—An Electrically-driven De Laval Oil Purifier.

Various methods have from time to time been evolved for reclaiming oil, and thus reducing expenditure, but it has remained for the De Laval Separator Co., of America and Canada, in conjunction with the Aktiebolaget Separator Co., of Stockholm (whose sole licensee for Great Britain and Ireland is Chadburn's (Ship) Telegraph Co., Ltd.), to apply centrifugal force to the purification of oil. It is claimed that the purifier instantaneously removes dirt, water, and other impurities from used oil, discharging pure oil from one spout, water and the lighter solids from another, and retaining the heavier impurities in the sediment pockets in the bowl. It makes it possible to retain with safety the same oil in service for much longer periods than is common at present, breaks up emulsions and prevents them from forming again, and greatly reduces the consumption of oil.

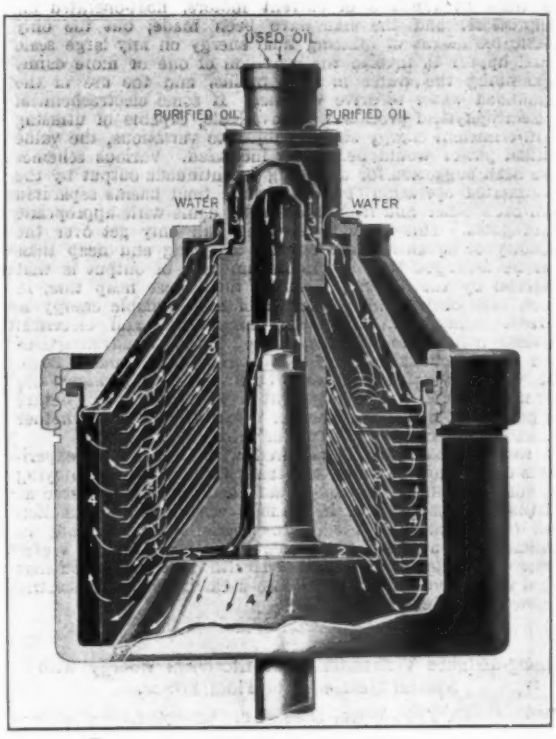


Fig. 2.—Purifier Bowl.

The lubricating oil purifiers are also adaptable in a slightly modified form for use in the dehydration of transformer oil, as will be explained later, and greatly simplify this operation by saving both time and labour. The necessary modification is simple and can be made in a short time so that there is no reason to prevent one machine from being used for more than one purpose. Amongst the numerous applications of the system the following may be particularly mentioned:—

Elimination of all impurities (liquid and solid) from lubricating oils and moisture from electrical insulating oils; reclamation of crankcase oils and gear greases; recovery of cutting oils and soda wash used on machine tools; treatment of edible oils and fats, &c.; the purification of quenching oils used in tempering operations, and of internal-combustion engine fuel oil. It may be added that crude oil suitable only for burning under boilers is being converted by the process into a high-grade fuel for internal-combustion engines, with a consequent saving of over £1 per ton.

The machine, fig. 1, comprises a pedestal casting in which a high-speed vertical shaft carries at its upper end a bowl, fig. 2; the impure oil enters at the top of the machine (through the strainer shown in fig. 1), passes downwards through the central tube (1) and out into the bottom of the bowl. The latter contains a number of truncated conical shells of thin sheet metal so arranged as to practically fill the whole of its interior and divide it into thin conical spaces. The oil flows upwards through the circular holes (2) in the cones into the spaces between them, and the heavier impurities (such as dirt and water) are thrown outwards into the annular space surrounding the cones, while the lighter purified oil travels inwards and upwards towards the central tube (3). Of the heavier impurities, the solid matter is retained on the periphery of the bowl, whence it must be removed at intervals; the water passes upwards (4) and out through the lowest outlet into a pan provided with a spout as shown in fig. 1. The pure oil leaves by the intermediate outlet and spout, while the top outlet only comes into use as an overflow in the event of the bowl becoming clogged with dirt.

Due to its construction, the bowl will adjust itself automatically to varying proportions of oil and water, and its

action is so perfect that if perchance no water enters the bowl with the oil, no discharge takes place through the water outlet; similarly, if water only is passed through the bowl, nothing will come out of the oil outlet.

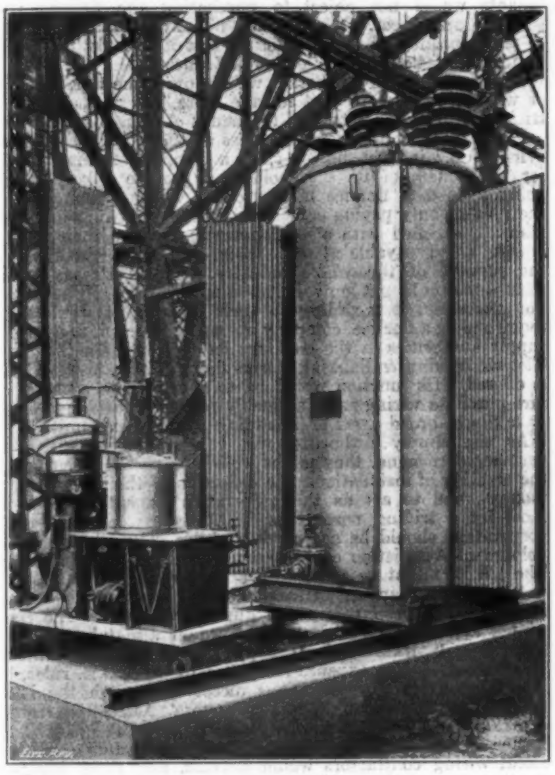


FIG. 3.—TRANSFORMER AND PURIFIER.

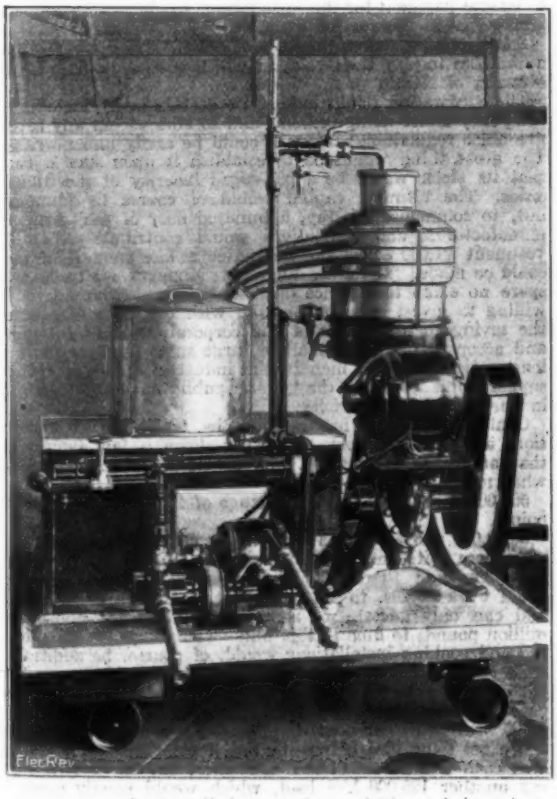


FIG. 4.—PORTABLE OIL PURIFIER.

With regard to the treatment of electrical insulating oils, American practice is to test oil to 40 kV. with the old style of test gap, 0.5 in. face and 0.2 in. separation, or 22 kV. with a 1 in. face and 0.1 in. separation. When the dielectric strength of the oil at the bottom level of the transformer has decreased 25 per cent. from the above value it should be removed and treated. For this purpose a stationary machine (fig. 1), and a portable set (figs. 3 and 4), have been developed. The oil is pumped from the bottom of the transformer through a bayonet type electric heater (which is only used when the oil to be treated is too thick), into the purifier; it is discharged into a small collecting tank from whence it is pumped back into the top of the transformer. The machines are supplied complete with electrically-driven pumps, electric heater, valves, &c., and a dual purpose bowl is provided, which consists essentially of a purifier bowl with an adjustable discharge diameter, and is provided with an additional top disk which is used when operating the bowl as a clarifier without the water seal. The bowl is used as a purifier only when an abnormal amount of water is present, or the oil is emulsified, in which case a water seal is employed, and the small blank disk is used in its regular place on the top of the small disks. But when functioning as a clarifier the water seal is, of course, discarded, and the blank top disk is inserted over the bottom disk. In this case care must be exercised to ensure that the bowl parts are free from moisture. Another precaution to be taken when heating the oil prior to circulating it through the purifier, is to make sure that it is heated to a temperature of at least 110 deg., but not over 150 deg. F., and on no account must it be heated with live steam. When considerable moisture is present in the oil it is recommended that the higher temperature be used.

In conclusion, it remains to be said that from test data obtained in the U.S.A., the machine appears to do what is claimed for it in an efficient manner. The largest purifier made is capable of dealing with 350 gallons per hour, requires a floor space of only 2 sq. ft., and less than 2 h.p. to drive it. The driving power may be applied either by belt, electric motor, or a steam turbine which forms an integral part of the machine. We are indebted to Mr. A. W. Empson, A.M.I.E.E., F.C.S., &c., for the loan of photographs and his assistance in the preparation of the above article.

THE HOPEFUL OUTLOOK IN RUMANIA.

THE fact that a very large proportion of the trade done under the British Government's export credit scheme has up till now been transacted with Rumania lends special interest to a report which the Department of Overseas Trade has recently issued from the pen of H.M. Commercial Secretary at Bukarest (Mr. Alexander Adams).

Seeing that in an agricultural country the progress of reconstruction is likely to be hastened or retarded by the harvest yield, it is most satisfactory to learn how excellent are the prospects of a grain surplus for export in the autumn.

All interests are striving towards the rapid reconstruction of the economic life of the country. The export merchant is struggling to get goods down to the shipping ports. The manufacturer is doing his best to replace lost and worn-out machinery, and to repair that still standing in his factory, in order that production may continue. The Government is doing its best to procure railway material and locomotives from abroad, and is aiding industrialists to procure machinery and the implements of production. Despite the present state of the railroads, manufacturers who are re-establishing their works have been given certain preferences with regard to the allotment of railway trucks for the transportation of machinery from the seaports.

Britain's Advantages.

With the newly acquired provinces, in which the Rumanian administration is gradually securing a firm foothold, the country becomes no inconsiderable one in the list of Britain's customers abroad. The Danube provides a highway for British goods into the heart of the country. Until the reconstruction of the railroads is accomplished, not only in Rumania but also in Central Europe, waterborne merchandise will be able to compete on more than favourable terms with that coming by rail, subjected as the latter is to high charges and intolerable delays.

Thus the British exporter is not only in a privileged position, but he has a certain period in which to make good his foothold before any considerable element of competition may be expected from late enemy countries.

In Mr. Adams's opinion, Rumania will probably be one of the first war convalescents to attain complete recovery. British enterprise and British capital may regard the country as a fertile field wherein honest endeavour will bring forth a bounteous harvest.

Import Possibilities.

The present partial elimination of Germany and Austria from the circle of suppliers gives the United Kingdom a magnificent opportunity to redeem her past neglect of this market and to take her stand as the principal supplier of manufactured goods. With the advantage of sea transport to the Danube doorstep of Rumania the United Kingdom is able to give quicker deliveries of merchandise to Rumanian importers than are possible to-day from Germany, or even the former Austria-Hungary, which two countries formerly held that advantage.

The breakdown of land transport in Central Europe has so far acted as an almost insuperable barrier to the sale of German or Austrian goods in Rumania in any large quantities, and may continue to do so, at any rate, for some years. During this time the British exporter will have every opportunity of making acquaintance with this market and of firmly establishing his goods in the favour of the ultimate consumer, but as the passage of every month brings with it an amelioration in the existing state of transportation, merchants and manufacturers interested in the future wants of this market with eighteen million customers are recommended to take steps as soon as possible to make themselves acquainted with those wants and the best means of supplying them.

In order to give an example of where the Rumanian market for British goods is capable of expansion, H.M. Commercial Secretary quotes particulars of certain United States imports into Rumania in 1913. Amongst them appear the following, in addition to quantities of agricultural machinery :—

	Tons	Lei
Pumps of all kinds for liquids, air or gas, also fans	126	151,942
Steam engines weighing from 500 to 2,500 kg.	79	119,791
Stationary engines and other special apparatus weighing 2,000 to 10,000 kg. per piece	116	116,830
Stationary engines and other special apparatus weighing 500 to 2,000 kg. per piece	80	96,897
Articles in metal	164	147,953
Instruments for boring wells and other bore-holes	252	302,572
Iron tubes and pipes	28,126	18,283,818

Other lines of British goods for which Rumania offers a market include electric dynamos and motors, fans, lamps, &c., and gas and oil engines.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

The Bradford Housing Scheme.

With reference to the statement by Messrs. Henley in this week's REVIEW, no doubt my own experience with a similar type of wire would interest your readers. I, myself, with the aid of a boy have on numerous occasions finished completely in 7½ hours, a four-point installation. That is to say, everything is completed, down to shades, including main switch and fuses, and as all furniture and linoleum had to be moved by us, you will, I think, agree with me that it is quite as good a performance as that of Messrs. Jessop & Boydell Ltd. I may state that at present myself and the same boy are installing the Walsall Continuity Grip system in a housing scheme, and our present rate of progress for wiring and tube work only, but including plugging walls and earthing, is eight lights in 7½ hours. Should any of your readers desire any further information, by all means give them my address.

Progress.

September 11th, 1921.

Electricity for All.

Much has been written of the squalid approaches to London, but I was never so impressed, as on one of the beautiful summer evenings last week, with the appearance of the backs of the houses from the train, and with the great need of electricity by the masses. About 80 per cent. of the houses had all their windows closed or nearly closed, and one could look into hundreds of rooms badly lighted by ill-placed gas brackets, whose greenish-yellow glare showed up the ceilings they had blackened, but gave little enough light where required. One could imagine the gas-vitiated atmosphere, the clammy heat, like a foretaste of the crossing of the Styx, and realise something of the horrors of gas lighting in these small overcrowded rooms.

In wondering whether in our time the clean, healthy, and cheerful electric lamp would reach these thousands of homes, an idea occurred to me which I ask your indulgence for space to outline. It seems Utopian at first, but as one turns over the suggestion a way seems possible which would not only benefit the health of the community at large, but bring employment and great prosperity to every section of the electrical industry.

The days when we had to fight the gas interests for our first footing have so far receded that we tend to forget the very solid foundations upon which the electricity supply industry stands. The indisputable advantages, to any but a gasman, of electricity from an hygienic point of view, its cleanliness and saving in decorations, its safety and convenience, make an irresistible appeal to those who can afford its installation. We are now practically face to face with the problem of how we are to bring its benefits to those who cannot afford the first expense, or who are not willing to lay out their money on premises held on short or expiring leases.

The latter is the real obstacle to the lighting of a vast number of houses, where if the wiring were installed the tenants would not object to purchasing the fittings and portable appliances. In both cases many would be willing to pay a portion of the installation cost if it could be apportioned in relation to their period of tenure.

The question then is whether we can overcome this difficulty or whether we are to wait for the more general use of electricity until all these tens of thousands of houses are rebuilt.

My suggestion lies along the lines of the old National Free Wiring Co.; instead, however, of a company formed purely for the benefit of its shareholders, I propose a corporation being formed to finance hire-purchase wiring schemes, with the idea of only paying sufficient interest to attract investors who are satisfied with a small return, provided their money is safe and repayable at par. This corporation should have the support of the whole industry, and all its important members should not only invest a portion of their reserves, but guarantee it according to their means. It would only require to be a finance company operating through the various supply authorities in the country; let us call it The National Electric Wiring & Banking Corporation, until a better name is offered. Its function would be to offer various schemes of hire-purchase wiring as on a weekly payment basis, quarterly, or taking a broad average by adding so much per unit.

As the supply authorities would reap the benefit of a permanent revenue, they might well be expected to supervise the erecting of installations, the collection of the hire-purchase moneys, and to act as the corporation's agents free or at most for a trifling percentage on the sums collected. The corporation should be everybody's child. The Electrical Development Association could perhaps undertake the publicity. The I.E.E. might be asked to draft from its rules a formula to establish a standard of material and workmanship as low as considerations of safety and durability permit. The committee appointed for this purpose might also take steps to remove any irksome local supply authorities' conditions, where they involve expense not called for by I.E.E. rules, by making suitable representations direct or through the Electricity Commissioners. The Contractors' Association might contribute data on the life of installations for the I.E.E. Committee to consider and prepare for the corporation's actuary. Local wiring contractors would canvass, and those bringing in the agreement would naturally have the order for the installation. The drafting of an agreement as between the corporation and its agents and the landlord and his tenants, to ensure payment for the installation, would not be difficult, seeing that all parties are to benefit.

Some new legislation might be necessary to empower supply authorities to play their part, in which the good offices of the Ministry of Health might be enlisted.

The corporation might extend its usefulness by including a fire policy under its agreement, and so eliminating any severe fire office regulations; this risk could be easily under-written. The great thing would be to establish it upon such a basis that its stock would be a gilt-edged security of the highest order. The ultimate capital would of course be immense, but, to commence, if, say, a hundred only of our principal manufacturers and institutions would contribute as an investment £1,000 each, and guarantee a like amount, a start could be made. There are thousands amongst our ranks who spare no effort to advance our industry, and who might be willing to invest small sums, and with this as a foundation the savings bank branch of the corporation could get going and accept deposits in small or large sums, and on short or long notice. All the men in the industry would give their support, and we know the general public has unlimited faith in the future of electricity.

Could we, after the first few months, tackle 500,000 installations a year? Anyhow, let us put down a few figures on that ambitious assumption, and try to get a rough idea of what might be done :—

500,000 installations at an average of 10 points = 5,000,000 points.

5,000,000 points at an average of 30 watts = 150,000 kW.

Suppose with modified wiring rules and men doing their best, knowing there was plenty more work waiting, we could work at 20s. to 25s. per point (I am not a contractor, and can only guess), we shall eventually want about five million pounds to finance this number of installations. Heating and cooking installations would, of course, be additional.

To get our money back in ten years, it would mean about 7d. or 8d. per week, which is nothing to pay and ample to cover capital, interest, and expenses. Stock could be issued at 95 bearing 6½ per cent. interest, repayable in 10-15 years.

We get some idea of possibilities if we suppose for a start that each of these additional consumers had an electric iron, say another 125,000 kW load, which would mostly come in slack periods, and give an improved diversity factor.

I shall be told that such a scheme could never be worked —I think it could, with the right spirit of co-operation; and that the initial capital could not be found—again, if the big men in the electrical industry took it in hand, I feel sure it could.

I hope, therefore, that this letter may provoke discussion

and produce constructive criticism. The tremendous impetus to the whole industry, bringing full employment to contractors, makers of plant, cables, meters, &c., the increased manufacturing output reducing costs and strengthening us in overseas competition, the increased station output spreading out capital charges and enabling a real cheapening of electricity for all purposes to come about, would re-act and help other industries; the possibilities are such that I hope leaders may be forthcoming and a united effort may be made to bring the National Electric Wiring Corporation into being.

Fred. M. West.

London.
September 10th, 1921.

Leading-in from Overhead Mains.

I would be grateful to know if any standard method has been adopted for leading-in to consumers' premises from overhead mains; several towns I have visited seem all to have methods of their own. I have never seen any discussion on this matter, but I am sure some of your readers will be in a position to give their experience from actual practice.

Spark.

September 12th, 1921.

Competitive Trials of Electrical Apparatus.

Many papers are read at various Institution meetings, and many letters appear in "Correspondence" columns, with regard to the practical efficiency of electric cooking and heating appliances, current limiters, meters, and various other electrical apparatus.

It would be of great advantage to the electrical industry if practical trials under working conditions were arranged by the I.E.E., or the E.D.A., similar to those conducted by the Royal Agricultural Society in connection with agricultural machinery.

Such trials could be held in connection with electrical exhibitions; the awards would be an excellent advertisement for the successful competitors, and would guide designers in their efforts to achieve perfection.

Arch. J. Howard.

Electricity Dept., Taunton.
September 10th, 1921.

Accumulator Froth.

Mr. A. E. Frost's letter in your issue of September 2nd, is one that cannot pass without notice.

He states that frothing only occurs in accumulators by certain makers, the cause being inferior quality celluloid.

Every manufacturer of small accumulators enclosed in celluloid cases has experienced frothing trouble at one time or another. Everyone who re-charges or repairs accumulators of all makes is aware of this. Is it likely that high-class manufacturers of accumulators would not make every endeavour to obtain, and use, the best quality celluloid obtainable, when the matter is of such importance to them?

It is certainly true that frothing is usually experienced when celluloid is used for the containing cell, but it does not follow that it is entirely due to the celluloid. It may be due to other causes which the celluloid may assist.

Frothing in most cases has its origin in the use of impure water, lime salts being deposited on the plates and interfering with the process of charging.

Camphor (which is extremely volatile) is one of the principal constituents of celluloid, and celluloid even at its best is not a particularly stable compound.

When trouble arises from impure water, the fact that the containing case and probably the separators are celluloid tends to assist and increase this troublesome complaint.

Wm. Peto.

Pritchett & Gold and E.P.S. Co., Ltd.

London.
September 8th, 1921.

Carpets and the Electric Suction Cleaner.

As an actual user of various kinds of cleaners in my home, I find the most satisfactory type for domestic use must certainly have a revolving brush, to flick off pieces of cotton or such-like material that become entangled in the pile or nap of the carpet. Suction alone is useless. The brush should *not* be driven by the motor, but be capable of being driven at varying speeds—fast or slow—to suit the varying classes of material it is desired to sweep up.

This is easily accomplished by coupling up the brush to one of the rubber-tired wheels on which the cleaner runs; thereby the brush is turned at any suitable speed as the cleaner moves over the carpet.

The brush should be of the toggle type, *i.e.*, a number of soft pencil-shaped brushes fixed staggered fashion to a hollow spindle. A light brush of this kind is much more effective than the continuous mesh brush; a simple rubber belt will drive it, no adjustment is necessary, the brush is instantly detachable—and easy to clean if long threads get wound upon it.

The "Rayvac" cleaner has these improvements, as well as ample suction power, with a big saving in time and labour as compared with the plain suction cleaner.

C. Geo. Nobbs.

London.
September 10th, 1921.

[Several letters on this subject have been received, extolling the virtues of specified models of cleaner. Our aim throughout has been to deal with the matter from the technical point of view, without regard to any particular make, and we feel that no useful purpose will be served by continuing this correspondence on the lines it is now following.—Eds. Elec. Rev.]

Supply without Statutory Powers.

Many thanks for your clear and full explanation in last week's issue of the position of unauthorised schemes under the new Acts. May I just say that in the case in my mind it is taken for granted that the existing small scheme cannot compete in price with the new and official scheme, and that any attempt by the former to obtain an Order would be opposed tooth and nail by the competent local authority, which in fact intends to get an Order itself.

Indeed, in this particular locality prominent members of the Labour party, which has a majority on the R.D.C., have said that they would shut down the existing plant at once, without waiting for an authorised supply, if they were able to do so, and they are in any case refusing further permits for poles where they can. This in spite of the fact that there is no gas, and that the advent of an authorised supply must be a matter of years.

As regards the other question—cost of power—I am afraid you do not do me justice. The figures mentioned were not intended to be taken as a full comparison at all, and the items you mention—interest, depreciation, rent, rates, labour, lubrication and repairs—were omitted on *both* sides. All the same, I freely admit that some of these items would be lower in the case of the electric motor, and obsolescence perhaps not counted at all.

Against your statement that I "tacitly assume that the oil engine set is going to run at full load and maximum efficiency when it runs at all," I put forward figures given in a technical journal last year, relating to the type of engine in question. The engine is of 5 h.p. The consumption at full load was .425 lb. of paraffin per b.h.p.-hour, and at 3 h.p., .46 lb., *i.e.*, well within the half pint mentioned at 60 per cent. of full load. These are test figures, certainly, but my experience is that the fuel consumption of oil engines need not exceed the test figures by any very serious amount, given reasonable treatment.

Further, the comparison was obviously favourable to electricity by reason of the small sets taken as examples, and the efficiency mentioned, 90 per cent., is not, if I remember, attained by electric motors of this size.

Consideration of, say, a 100-h.p. modern steam, suction gas, or crude oil plant, running ordinary factory hours, would be perhaps more useful. Is it certain, even where a final drive by electric motor is convenient and desirable, that a plant such as mentioned, driving a generator, would not be cheaper in very many cases than a supply from a far distant hydro-electric station, delivered to the works at 2½d. or 3d. a unit?

A. O. G.

September 12th, 1921.

[Why the Labour members of the Rural District Council should wish to shut down the plant in question is a mystery that we cannot fathom. With regard to the cost of power, we regret that our correspondent feels that we have not done justice to his figures, in our brief reference to this subject; we merely wished to utter a warning against hasty and incomplete estimates of comparative cost. We do not know the nature of the small plant to which he refers, but he appears to be satisfied "that the existing small scheme cannot compete in price with the new and official scheme"; yet he questions whether an outside supply at 2½d. or 3d. a kWh can compete with a private installation.—Eds. Elec. Rev.]

Organ Blowers.

In changing over from d.c. to a.c. the church organ blower motor offers a peculiarly difficult problem. The ordinary d.c. organ blower motor is controlled easily enough by means of a resistance in the armature circuit. The a.c. motor, on the other hand, runs at a constant speed, and is also liable to make an unpleasant noise, which is intolerable in a church. An account of methods by which the difficulties have been overcome will be welcomed by

Organ Blower.

September 12th, 1921.

The E.P.E.A. Schedule and Economy Stunts.

What good does "Anti-Bunkum" hope to achieve by rattling the sabre, and why should he waste time in lashing himself into such uncontrollable fury over a weak, powerless Association such as the E.P.E.A.?

Being a believer in sweated labour, as "Anti-Bunkum" practically admits himself to be, has it never occurred to him

that it is he and the small minority who think with him who are largely responsible for the existence of the E.P.E.A. and similar associations?

I think it will be generally admitted by all unbiased and fair-minded individuals that, prior to the war, the staffs in the majority of central stations did not receive anything like adequate remuneration for the services they were called upon to render. Now, unfortunately, in many cases the pendulum appears to have swung a good deal too far in the other direction, and salaries and wages will undoubtedly have to be modified and put on a commercial basis, not only in our own but in all other industries, if the country is to regain its old-time prosperity.

As usual, the extremists on both sides appear to think that there is only one side to the question, and that side their own. Let us, therefore, before attempting anything, scrap the extremists as being incapable of contributing anything useful to the discussion on this matter, and then, and only then, will there be some real prospect of a sane and reasonable solution of this difficult problem.

In conclusion, I may say that I hold no brief for the E.P.E.A. and am not a member of the same, nor do I agree with the somewhat bragging tone of Mr. Arthur Jones's letter. At the same time, I would suggest that in writing letters, such as the one published in your issue of September 2nd, "Anti-Bunkum" only lays himself open to the contempt and disgust of all who are capable of looking at this matter from a fair and unprejudiced point of view.

Borough Electrical Engineer.

September 6th, 1921.

[Other letters have been received in similar vein, supporting the E.P.E.A. and reproving "Anti-Bunkum."—EDS. ELEC. REV.]

A Motor Problem.

Although Mr. Davies's motor problem lacks detail, it is obvious that the trouble is due to the frequency of his supply mains. From the information given it would appear that the machine in question is designed for a frequency in the neighbourhood of 60 cycles. This is borne out by the test he applied. The most noticeable change when the frequency is increased or decreased is the speed of the rotor. Synchronous speed=cycles × 120/number of poles. When the frequency is decreased as in our case, there is a corresponding decrease in speed. Also the back voltage which opposes the line e.m.f. is equivalent to flux times the frequency. If frequency is decreased, flux must be increased. Results: iron over saturated, stray power loss, magnetising current considerably increased, and undue heating. There is only one way out of his difficulty, that is, to have the winding redesigned, unless he adopts the following method, which will involve a considerable sacrifice of horse power: Vary the voltage in the same ratio as the frequency (60 cycles to 25 cycles). The result will be increased amperes, decreased watts, torque unchanged, decreased efficiency, increased power factor, decreased horse power. As Mr. Swindlehurst points out, I also fail to see how the horse power and the voltage were determined from the data supplied. From the diagram I presume the motor is of the split-phase starting type, commencing its work as a two-phaser. Mr. Davies is evidently aware that this winding may be made suitable for different voltages by a series, series parallel, or parallel arrangement. I shall be pleased to discuss the subject further, if Mr. Davies cares to furnish further information.

W. Pinkerton.

Manchester.
September 12th, 1921.

NEW PATENTS APPLIED FOR, 1921.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. SEPTON-JONES, O'DELL AND STEPHENS, Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

22,825. "Electric photographic printing or copying machines." J. B. Halden and J. Halden & Co., Ltd. August 29th.
22,838. "Electric switch." L. W. Moxham. August 29th.
22,857. "Wireless telegraphic and telephonic apparatus." W. H. Allen. August 29th.
22,858. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. August 29th. (United States, March 15th.)
22,860. "Electro-magnetic apparatus for recording sound." A. F. Sykes. August 29th.
22,861. "Direction-finding apparatus for wireless telegraphy." G. W. Harris, B. Hodgson, C. E. Horton, and L. G. Preston. August 29th.
22,870. "Electric light fittings with bowl shades or reflectors." H. C. Pride. August 29th.
22,875. "Control means for electric motors." Igranic Electric Co., Ltd. (Cutler-Hammer Manufacturing Co.). August 29th.
22,881. "Separating metals by electrolysis." N. V. Hybinette. August 29th.
22,894. "Wireless telegraphic apparatus." W. H. Wilson. August 29th.
22,897. "Electrical apparatus." American Radio & Research Corporation. August 29th. (United States, August 30th, 1920.)
22,906. "Incandescent electric lamp." K. Nishimoto. August 29th.
22,910. "Apparatus for diminishing centrifugal force in rotors of fast-running electrical machines." Akt.-Ges. Brown, Boveri et Cie. August 29th. (Switzerland, September 9th, 1920.)
22,930. "Alternating current dynamo." T. Cooper. August 30th.
22,964. "Combination electric radiator and hot-water circulator." A. Robertson. August 30th.
22,982. "Lamps, search lights, &c." J. G. Smith. August 30th.
22,990. "Devices for balancing currents in parallel connected conductors for heavy alternating currents'" A. B. Field and Metropolitan-Vickers Electrical Co., Ltd. August 30th.
22,999. "Rectifiers for high-potential alternating electric currents." A. C. Goolden, A. R. Greatbatch, and V. E. Pullin. August 30th.
23,001. "Electric maximum automatic cut-out." D. J. B. Koolhaas. August 30th. (Holland, August 30th, 1920.)
23,004. "Alternating current track signalling." L. H. Peter and Westinghouse Brake & Saxby Signal Co., Ltd. August 30th.
23,013. "Signalling systems." Radio Communication Co., Ltd., and J. Scott-Taggart. August 30th.
23,018. "Commutators, &c., for ignition current in internal combustion engines." F. J. Brougham (Walker Accessories Co.). August 30th.
23,020. "Holders for electron discharge devices, &c." C. G. Eden and General Electric Co., Ltd. August 30th.
23,021. "Electric motor starters." British Thomson-Houston Co., Ltd. (General Electric Co.). August 30th.
23,034. "Circuit closers for electrically-operated alarm mechanism." G. W. Wacker. August 30th.
23,040. "Circuit closers for electrically-operated alarm mechanism." G. W. Wacker. August 30th.
23,044. "Electric lamps." S. J. Levi and H. Rottenburg. August 30th.
23,066. "Accumulator battery." J. R. Palmer and W. C. Ashton. August 31st.
23,073. "Electrical bonding junction boxes for metallic sheathed wires, &c." L. F. Moyle. August 31st.
23,080. "Well globe fittings for electric lamps." C. A. Ely. August 31st.
23,091. "Motor-driven sewing machine." W. C. Fairweather (Diehl Manufacturing Co.). August 31st.
23,103. "Electric light switches." G. W. Becherraz. August 31st.
23,138. "Electric motor, &c., controllers." C. J. Gordon. August 31st.
23,144. "Electric current limiting devices." British Thomson-Houston Co., Ltd. (General Electric Co.). August 31st.
23,149. "Electrodes for electric welding, cutting, &c." A. C. Cutting, Welding Co., Ltd., W. H. Flood, and D. T. Smout. August 31st.
23,154. "Process for rapid energising of magnets." Akt.-Ges. Brown, Boveri et Cie. August 31st. (Switzerland, September 9th, 1920.)
23,157. "Control clocks for trunk-line switchboards." Allmanna Telefonaktiebolaget L.M. Ericsson. August 31st. (Sweden, May 30th.)
23,168. "Method of mending electric resistance elements." N. Carrico and F. C. Hughes. August 31st. (United States, September 11th, 1920.)
23,223. "Galvanic batteries for medical purposes." J. Armstrong. September 1st.
23,229. "Electric wire union." W. Thompson. Septemb 1st.
23,232. "Process for production of electric insulating material." E. Juchli. September 1st. (Switzerland, September 1st, 1920.)
23,234. "Automatic electric couplings." Westinghouse Air Brake Co. September 1st. (United States, June 1st.)
23,241. "Manufacture of storage battery electrodes." R. E. Beswick and Fuller's United Electric Works, Ltd. September 1st.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1920.

5,431. "Circuit breakers for electrically-heated devices." E. C. R. Marks (Landers, Frary & Clark). February 23rd, 1920. (167,799.)
7,912. "Air-cooled or evaporative surface condensers." J. McLeod. March 17th, 1920. (167,803.)
10,561. "Electrolytic apparatus." M. M. Merritt. April 15th, 1919. (141,733.)
12,834. "Electric accumulators." A. Pouchain. May 8th, 1920. (167,821.)
13,077. "Sparking plug adaptors." A. W. Smith, V. W. V. Harris, C. Johnson, and T. E. Taylor. May 11th, 1920. (167,826.)
13,184. "Electric reading lamps." Soc. Valenducq Frères et Dubois. May 30th, 1914. (143,248.)
13,278. "Resistance switches for controlling the intensity of electric currents." J. Watkinson, N. C. Francis, and A. E. Quennell. May 13th, 1920. (Cognate application, 13,279, 1920.) (167,832.)
13,352. "Thermionic devices." Western Electric Co., Ltd. November 1st, 1916. (143,262.)
13,437. "Electric switches." British Thomson-Houston Co., Ltd. (General Electric Co.). May 15th, 1920. (167,840.)
13,438. "Electric cables." H. Bevis and Pirelli-General Cable Works, Ltd. February 5th, 1921. (167,841.)
13,518. "Electric switches or circuit breakers." A. Reyrolle & Co., Ltd., and B. H. Leeson. May 17th, 1920. (167,846.)
13,602. "Storage and supply of electrical energy by an electrochemical process." F. P. Habicht. May 17th, 1919. (143,532.)
13,766. "Electrically-heated appliances." G. H. Lofts. May 19th, 1920. (167,860.)
13,905. "Duplex electric welding machines." J. Ledwinka. May 20th, 1920. (167,873.)
14,774. "Electric meters." British Thomson-Houston Co., Ltd. (General Electric Co.). May 31st, 1920. (167,890.)
15,346. "Electric meters particularly of the mercury motor type." British Thomson-Houston Co., Ltd., and A. P. Young. June 7th, 1920. (167,907.)
15,861. "Manufacture of metallic diaphragms of electrolytic cells." R. Pschkranz. June 12th, 1919. (144,719.)
15,947. "Electrical transformers." G. Schroeder. June 12th, 1920. (167,916.)
16,404. "Electrical signalling by means of alternating currents." L. de Forest. March 13th, 1920. (160,430.)
16,838. "Electrical contacts of the plug and socket type." S. J. Thomas. June 22nd, 1920. (167,932.)
16,862. "Electric power generating sets." A. Biro. February 3rd, 1919. (145,512.)
17,744. "Apparatus for electrical treatment of gases." A. L. Mond (International Precipitation Co., Inc.). June 29th, 1920. (167,939.)
19,341. "Means for maintaining constant the speed of an electric motor." Ges. fur Drahtlose Telegraphie. February 9th, 1916. (147,438.)
19,343. "Arrangement for locating underground or hidden electrical conductors." Ges. fur Drahtlose Telegraphie. November 23rd, 1917. (147,440.)
19,347. "Electrical frequency multipliers." Ges. fur Drahtlose Telegraphie. October 26th, 1918. (147,444.)
20,744. "Electric advertising signs." O. Fehler. June 6th, 1918. (148,918.)
22,458. "Electric controlling devices." British Thomson-Houston Co., Ltd., and V. E. Hall. July 28th, 1920. (167,957.)
24,833. "Telephone or other call indicators." Siemens Bros. & Co., Ltd., E. A. Petithory, and J. E. Collyer. August 27th, 1920. (167,966.)
29,668. "Interrupting devices for electric circuits." Metropolitan-Vickers Electrical Co., Ltd. November 6th, 1919. (153,573.)
30,968. "Electrically-heated ovens." F. Graf. November 11th, 1919. (153,899.)

1921.

493. "Electric switches, ceiling roses, plug and socket couplings, closures for junction boxes, and other analogous devices." A. Davis and F. R. Hudson. January 6th, 1921. (168,001.)
6,767. "Condensers for refrigerating machines." P. Fischbacher. May 18th, 1920. (Divided application on 167,858.) (168,008.)
17,394. "Electric rotating furnaces." C. E. Cornelius. April 13th, 1920. (Divided application on 10,293, 1920.) (168,018.)